

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel,)
W.A. DREW EDMONDSON, in his)
capacity as ATTORNEY GENERAL)
OF THE STATE OF OKLAHOMA,)
et al.)
Plaintiffs,)
vs.) No. 05-CV-329-GKF-PJC
TYSON FOODS, INC., et al.,)
Defendants.)

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TRANSCRIPT OF NONJURY TRIAL PROCEEDINGS
JANUARY 7, 2010
BEFORE GREGORY K. FRIZZELL, U.S. DISTRICT JUDGE

REPORTED BY: *BRIAN P. NEIL, CSR-RPR, RMR, CRR*
United States Court Reporter

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1 Thursday, January 7, 2010

2 * * * * *

3 THE COURT: Mr. George.

4 MR. GEORGE: Thank you, Your Honor.

5 **CONTINUED DIRECT EXAMINATION**6 **BY MR. GEORGE**7 Q. Good afternoon, Dr. Bierman. Before lunch,
8 we discussed some of the errors and problems that you
9 had noted in the work of Dr. Engel and Dr. Wells.

10 A. Yes.

11 Q. Do any of these errors and problems impact
12 the work of other experts retained by the State of
13 Oklahoma?

14 A. Yes, they do.

15 Q. And which experts?

16 A. Drs. Stevenson, Cooke, and Welch.

17 Q. And could you explain the impact of the
18 things that we've discussed regarding Dr. Engel and
19 Dr. Wells' modeling on those experts' opinions?20 A. Right. The flawed and unreliable results
21 that flowed from Dr. Engel's work flowed into
22 Dr. Wells' work, and the flawed and unreliable results
23 resulting from Dr. Wells' model flowed into the work
24 by Drs. Cooke and Welch.

25 And backing up one step, Dr. Engel's flawed

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1 predictions for total phosphorus flowed in the work of
2 Dr. Jan Stevenson.

3 MR. GEORGE: Your Honor, I'll pass the
4 witness.

5 THE COURT: Cross-examination.

6 MR. PAGE: Yes, Your Honor. Thank you.

7 **CROSS-EXAMINATION**

8 **BY MR. PAGE:**

9 Q. Good afternoon, Dr. Bierman. It's good to
10 see you again.

11 A. Good afternoon, Mr. Page. My pleasure.

12 Q. Dr. Bierman, before we get started in some of
13 my cross-examination, I would like to ask you -- I
14 have a couple questions on Defendants' Joint Exhibit
15 2415.

16 MR. PAGE: Would someone please put that
17 up for us?

18 Q. (BY MR. PAGE) And, Dr. Bierman, I don't
19 remember what tab it was, but it's the one where you
20 had -- you were talking about the sensitivity analysis
21 that you did -- excuse me?

22 (Discussion held off the record)

23 Q. (BY MR. PAGE) Tab 3. Thank you. Yeah,
24 there it is up on the board.

25 MR. PAGE: Thank you, Mr. Todd.

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1 Q. (BY MR. PAGE) Now, I have just a couple
2 questions just about how the graph works.

3 The blue lines at the top are what you
4 proposed as a sensitivity analysis for
5 wastewater-treatment plant inputs; correct? That's
6 what you assumed for the sensitivity analysis?

7 A. Well, yes. I pulled out Dr. Engel's
8 wastewater-treatment plant loads, and I put in the
9 wastewater-treatment plant loads corresponding to my
10 blue lines in the top panel of this exhibit.

11 Q. Okay. And that's a hundred-million pounds;
12 is that correct?

13 A. I think it is. I can't quite read
14 the -- yes, I believe that's correct.

15 Q. Okay. And so you tried to do the same thing
16 with nonpoint source; that is, in the lower graph on
17 the same exhibit, you wanted to put in a
18 hundred-million pounds also for nonpoint source?

19 A. No. That wasn't the way these were derived.

20 Q. I guess my question, though, sir, is, it
21 shows here in your exhibit that you have a
22 hundred-million pounds -- the top one's
23 wastewater-treatment plant inputs, right, the blue
24 bars?

25 A. Yes.

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1 Q. And the bottom one is nonpoint-source inputs
2 that you used. Was it your intent to put the exact
3 same phosphorus input changes for both
4 wastewater-treatment plant and nonpoint source?

5 A. No, that was not my intent.

6 Q. So is this a mistake on the bars?

7 A. No, I don't think the bars are in error.
8 These two sensitivity analyses were conducted
9 independently.

10 Q. Okay. But your inputs for
11 wastewater-treatment plant, if I understand your
12 testimony, was a hundred-million pounds for each of
13 these years, '98 through 2006, as shown in the top
14 graph; correct?

15 A. I don't know the exact number. And as I
16 pointed out, it's a log scale. It's very difficult to
17 draw -- to pull out the absolute numbers off of these
18 graphs. If I can --

19 Q. Well, no. Dr. Bierman, it just appears to me
20 that you used the same hypothetical for both nonpoint
21 source and point source, at least that's what it shows
22 here by looking at your graph, but that wasn't your
23 testimony; is that correct?

24 A. No. I don't accept the premise of your
25 question, Mr. Page. I would have to look at the

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1 actual numerical values in the model files I used to
2 confirm what the numbers were. They appear
3 approximately the same on this log scale, but the
4 numbers were not exactly the same. That was not my
5 intention to make those numbers the same at all.

6 Q. Okay. Well, let me look at something else,
7 another apparent similarity, and that has to do with
8 Engel's wastewater-treatment plant loads in the upper
9 graph versus Engel's nonpoint-source loads in the
10 lower graph. Those are the red bars.

11 Is it your position, sir, that Dr. Engel's
12 loading analysis from his model is that the point
13 sources and the nonpoint sources are the same?

14 A. No, sir. That's not --

15 Q. Isn't that what this graph here shows?

16 A. I don't share the opinion that that's what
17 this graph shows. Because, again, this is a log
18 scale, and one cannot attribute numbers accurately to
19 the heights of these bars.

20 Furthermore, Dr. Engel's wastewater-treatment
21 plant loads and the nonpoint-source loads, as they're
22 depicted in these graphics, were taken directly from
23 his -- the third version, the October 15 version, of
24 his P routing model.

25 Q. Well, Dr. Bierman, when you say it's a log

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1 scale, both charts are log scales; correct?

2 A. Yes.

3 Q. Okay. So the location for the red bar for
4 sample under 1998 on the lower chart, if it has the
5 same location in the upper chart, it represents the
6 same value, does it not?

7 A. If it had the same location, but I'm not sure
8 we can draw that inference just by visually inspecting
9 these graphs.

10 Q. Well, do you know, sir, today whether or not
11 Dr. Engel's model showed that the point-source
12 phosphorus discharges for each year were equivalent to
13 the nonpoint-source loadings in this watershed?

14 A. I don't recall the relative magnitudes of his
15 point-source loads and his nonpoint-source loads that
16 he put into his routing model.

17 Q. So sitting here today, you don't even recall
18 whether or not Dr. Engel's point-source results from
19 his model were the same as the nonpoint source?

20 A. No, that's not what I said. My recollection
21 is -- and I don't have the specific numbers to put to
22 it -- but my recollection is that the nonpoint source
23 numbers that he put into his routing model, which are
24 computed by his GLEAMS model, were, in fact, higher
25 than the point-source loadings that he put into that

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1 model.

2 Q. And you're saying that the fact that you've
3 got it looking similar here today is kind of -- we
4 just can't read it properly because it's hard to tell
5 from this chart?

6 A. To say that they're similar on a log plot is
7 not to say that the numbers are the same.

8 Q. Okay, sir. I want to talk to you a little
9 bit about your experiences with regard to watershed
10 runoff modeling.

11 Isn't it true, sir, that you have limited
12 experience in running watershed models?

13 A. No, sir. I disagree that premise.

14 Q. Well, you mentioned a couple of examples of
15 your experience during the qualification part of your
16 testimony. One was the Calahoochie -- I don't know if
17 I can pronounce that right -- the Calahoochie?

18 A. Caloosahatchee. It took me awhile to learn
19 how to pronounce that as well.

20 Q. Thank you very much. Caloosahatchee -- we'll
21 let the court reporter learn how to spell that --
22 estuary. You mentioned that one.

23 Isn't it true in that case, you just actually
24 reviewed the modeling application, you didn't do it
25 yourself?

1 A. That's correct. I reviewed the data, I
2 reviewed the model, and I reviewed the underlying
3 science.

4 Q. But you didn't actually run the model there,
5 did you, sir?

6 A. Not for that project, no.

7 Q. And about the Saginaw Bay project, was that
8 also one of the projects you mentioned also as part of
9 your experience?

10 A. I mentioned the Sag -- I mentioned today that
11 had I worked on Saginaw Bay, but I don't think I put
12 that forth as an example of watershed experience.

13 Q. Okay. So you wouldn't claim that.

14 How about Chesapeake Bay? You mentioned
15 that. But you didn't do any watershed modeling in
16 that case, did you, sir?

17 A. I didn't conduct any. We used the results
18 from the Chesapeake Bay watershed model.

19 Q. And the Everglades model I think you
20 mentioned as a piece of experience for watershed
21 modeling.

22 But isn't it really true, sir, that in that
23 case you worked with the South Florida Water
24 Management District, and as far as the runoff portion;
25 that is, the watershed runoff portion, the South

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1 Florida Watershed Management District actually did
2 that watershed modeling. Correct?

3 A. Not completely correct.

4 Q. Not completely correct.

5 A. We used the -- the hydraulic chassis for that
6 model was the South Florida Water Management District
7 two-by-two hydrology model. That model existed before
8 we started our project. My assignment was to build a
9 phosphorus transport fate -- overland transport and
10 fate and transport and fate model through the canal
11 and network system for phosphorus.

12 Q. Right. But the runoff component was already
13 built for you, you just incorporated that into your
14 model, you linked them together; correct?

15 A. Not exactly. The hydrology component -- we
16 built upon the hydrology component. But when we added
17 phosphorus, we computed phosphorus runoff and that was
18 new, that was not given to us.

19 Q. Is it true, sir, for that particular model
20 that the folks that actually determined the quantity
21 of field runoff were the South Florida Water
22 Management District folks?

23 A. Do you mean experimentally measured?

24 Q. Yes.

25 A. Yes. Because we did the modeling. We did

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1 not do any sampling or experimental measurements as
2 part of that program.

3 Q. And it was the South Florida Water Management
4 folks that actually identified the particular sources
5 of field runoff for phosphorus also in that
6 application; is that also correct?

7 A. They gave us the data and we processed the
8 data and quantified the sources.

9 Q. Now, Dr. Bierman, you mentioned that you've
10 been working in the modeling area for about 36 years.

11 Isn't it true, sir, that during that whole
12 36-year period of time you've actually run an upland
13 watershed model yourself just a small number of times?

14 A. My actual hands-on experience?

15 Q. Yes, sir.

16 A. Well, the 36 years of experience you refer to
17 involves the science behind the physics, the
18 chemistry, and the biology of the models that you
19 refer to.

20 Q. Okay. Now, Dr. Bierman, what I'd like you to
21 do, please, is just answer my question. I didn't ask
22 you about whether you understood the science. I asked
23 you, sir, whether or not just the amount -- the actual
24 hands-on running of a watershed model, you've only
25 done that a few times in your 36 years of experience?

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1 A. A limited number of times, yes.

2 Q. And it's also true, sir, that you've never
3 published anything in a peer-reviewed journal that
4 relates to uplands watershed modeling; that is, that
5 your piece of that publication related to uplands
6 watershed modeling?

7 A. That doesn't mean I haven't done good science
8 in that area.

9 Q. Dr. Bierman --

10 MR. PAGE: I move to strike as
11 nonresponsive, Your Honor.

12 THE COURT: Sustained. Dr. Bierman, if
13 you'll just contain yourself to the substance of the
14 question, and Mr. George will have an opportunity to
15 ask follow-up questions.

16 THE WITNESS: Okay. Sorry, Your Honor.

17 A. Mr. Page, please repeat the question, sir.

18 Q. (BY MR. PAGE) Sure, Doctor. Isn't it true,
19 sir, that you haven't ever published anything in a
20 peer-reviewed journal that relates to uplands
21 watershed modeling?

22 A. We published -- no, that's not true. The
23 paper we published in ecological modeling represents
24 the overland transport of phosphorus and the
25 phosphorus transport through the canal system for half

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1 of south Florida.

2 Q. Okay. And that was the Everglades model that
3 we just talked about; correct?

4 A. Yes, that's correct.

5 Q. And that's where the South Florida Water
6 Management District, though, actually did the upland
7 portion of the analysis; correct?

8 A. Please define what you mean by "upland."
9 Because we certainly represented overland and
10 phosphorus transport through the overland areas and
11 the canal system for half of south Florida.

12 Q. Well, the South Florida Water Management
13 District actually determined the runoff for that piece
14 of work; correct?

15 A. No, that's not correct. They told us -- they
16 gave us data which represented the boundary conditions
17 for that model, and we then took those boundary
18 conditions and computed transport throughout the
19 entire Everglades area.

20 MR. PAGE: Your Honor, may I approach?

21 THE COURT: You may.

22 (Discussion held off the record)

23 Q. (BY MR. PAGE) Now, Dr. Bierman, do you
24 remember having your deposition taken in this case?

25 A. Oh, yes, I do.

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1 Q. Would you please turn to page 282 of your
2 deposition, which I've handed to you, sir?

3 A. 282.

4 Q. I'm going to start at the -- start at the
5 bottom of page 282 at line 19 and then go over to the
6 top of page 283.

7 A. I'm getting there.

8 MR. GEORGE: Your Honor, I object. It's
9 not proper impeachment. The passage that's been
10 identified by Mr. Page is completely consistent with
11 what the witness has testified to on the stand
12 today.

13 THE COURT: Okay. Let me take a look.

14 MR. PAGE: It's 282, line --

15 THE COURT: Yes, I have it. Is that
16 inconsistent, Mr. Page, with what he's testified here
17 to today?

18 MR. PAGE: I believe so, Your Honor.

19 THE COURT: How so?

20 MR. PAGE: He testified that he
21 published in a journal article for this particular
22 project work on overshed -- excuse me -- overland
23 runoff modeling, and the people that actually did that
24 work were the South Florida Management Water
25 District.

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1 THE COURT: Let me go back and just take
2 a look at this specific question and the specific
3 answer.

4 I see. The objection's overruled.

5 MR. GEORGE: Your Honor, could I be
6 heard briefly?

7 THE COURT: Yes, sir.

8 MR. GEORGE: I do appreciate the court's
9 ruling, but the testimony that is at issue doesn't
10 relate -- in the deposition does not relate to running
11 the model which is what Mr. Page's premise with the
12 cross-examination is.

13 Dr. Bierman's already testified that the
14 field measurements as to runoff in that particular
15 project were completed by the South Florida Water
16 Management District, and that's what this deposition
17 testimony is discussing.

18 THE COURT: It may be a simple failure
19 to communicate here. But the question that Mr. Page
20 put was whether or not the South Florida Water
21 Management District actually determined the runoff,
22 which is actually almost identical to the question
23 asked in the deposition. The answer in the deposition
24 was "yes." So the objection's overruled.

25 Go ahead.

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1 Q. (BY MR. PAGE) Okay. Would you follow with
2 me, sir, on the bottom of page 282, line 19?

3 "QUESTION: Okay. And so the folks that
4 actually determined the quantity of field runoff was
5 the South Florida Water Management folks; is that
6 correct?

7 "Yes, that's correct.

8 "And they were the ones that also identified
9 the particular sources of field runoff for phosphorus
10 also; correct?

11 "Into this model domain, that's correct."

12 Were you asked those questions and did you
13 give those answers under oath the day of your
14 deposition?

15 A. Yes, I did. The --

16 Q. That's fine, Dr. Bierman. Thank you.

17 Now, Dr. Bierman, is it also true, sir, that
18 in this case, the IRW, this was the first time that
19 you've ever worked with the GLEAMS model?

20 A. It's not the first time I've worked with the
21 science, but it's the first time I've worked with the
22 GLEAMS model tool, that's correct.

23 Q. Okay. And is it also true, sir, you've never
24 worked with another well-known watershed runoff model,
25 SWAT?

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1 A. I have never worked with SWAT, that's
2 correct.

3 Q. And SWAT has the same com -- at least very
4 similar components for the runoff portion as GLEAMS;
5 is that correct?

6 A. Some of them are similar.

7 Q. And would you agree with me, Doctor, that
8 Dr. Engel has much more experience than you do in the
9 area of runoff modeling?

10 A. I would dispute that he has more experience
11 than I do in the science that underlies runoff
12 modeling because that science is physics, chemistry,
13 and biology and mass balance. And, sir, I have 36
14 years of experience doing that.

15 MR. PAGE: Your Honor, I move to strike
16 as nonresponsive.

17 THE COURT: Overruled. Your question
18 was to the area of runoff modeling which encompassed
19 the substance of his answer.

20 Q. (BY MR. PAGE) Dr. Bierman, would you agree
21 that Dr. Engel has more experience with actual
22 operating -- actually running runoff models than you
23 do?

24 A. Yes.

25 Q. Now, I want to talk a little bit now, sir,

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1 about these assumptions that you critiqued on the
2 GLEAMS model that we've talked about this morning.

3 A. Yes.

4 Q. It's true, is it not, sir, that you did no
5 analysis to determine whether or not the conditions or
6 the assumptions that Dr. Engel selected for his GLEAMS
7 model were not representative of site-specific
8 conditions in the IRW?

9 A. I can't provide an answer to a question that
10 broad. Could you please be more precise, sir?

11 Q. Well, I thought it was pretty -- pretty
12 precise.

13 You did no analysis, sir, to determine
14 whether or not the conditions that Dr. Engel selected
15 for his GLEAMS model were not representative of
16 site-specific conditions in the IRW?

17 A. Well, that depends what conditions. That
18 model requires a great deal of input. I just
19 testified to an analysis we did this morning of how
20 Dr. Engel took the NLCD data and classified land uses.
21 I certainly did that analysis and, as I testified to,
22 I discovered numerous errors in those inputs.

23 Q. Dr. Bierman, would you please turn to page
24 374 of your deposition?

25 A. I'm here.

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1 Q. Okay. At the bottom on line 23, during your
2 deposition, were you asked this question and did you
3 give this answer?

4 Okay. Did you do any analysis, sir, to
5 determine that the conditions that Dr. Engel selected
6 for his GLEAMS model were not representative of
7 site-specific conditions in the IRW?

8 "ANSWER: No, because it wasn't my model."

9 Were you asked that question and did you give
10 that answer at your deposition, sir?

11 A. Yes, I did. And I took that question to mean
12 input coefficients. I didn't -- at the time I'm sure
13 I didn't take it to mean the land use analysis.

14 Q. Now, Dr. Bierman, I want to talk a little bit
15 about the phosphorus inputs testimony you did this
16 morning. Do you remember Tyson Defendants
17 Demonstrative 230?

18 MR. PAGE: Could we have that, please?
19 I don't recall what tab it was again.

20 *(Discussion held off the record)*

21 A. I'm sorry. Which tab, please?

22 Q. (BY MR. PAGE) Tab No. 9.

23 A. Okay. I've got it.

24 Q. Now, it's true, is it not, sir, that you
25 haven't in your modeling experience actually reviewed

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1 soil test phosphorus data for input into a runoff
2 model?

3 A. That's not correct.

4 Q. It's not correct. Okay.

5 A. I've done -- I have -- in the course of
6 scientific peer review of watershed models, I have
7 reviewed initial condition for soil phosphorus
8 concentrations for watershed models; for example, in
9 Lake Okachobee.

10 And if we're construing soil test phosphorus
11 to mean soil test phosphorus as we've talked about it
12 in this case here, I'm not used to referring to it as
13 "soil test phosphorus."

14 Q. Okay. Well, let's turn to page 328 of your
15 deposition, Dr. Bierman.

16 A. Sure. I'm sorry. 328 did you say?

17 Q. Yes, sir.

18 A. Okay. I'm there.

19 Q. Thank you, sir. On line 4 during your
20 deposition, were you asked this question and were
21 you given -- did you give these answers?

22 "QUESTION: Have you ever, sir, reviewed soil
23 test phosphorus data for use in a runoff model?

24 "ANSWER: I reviewed the materials produced
25 in this case.

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1 "QUESTION: Prior to the review of this case,
2 have you ever done that analysis in a modeling
3 framework?

4 "ANSWER: No."

5 Did you provide those answers to those
6 questions during your deposition, sir?

7 A. Yes, I did. That's what the transcript says.

8 Q. Now, I want to talk a little bit about this
9 soil phosphorus that you show here in Tyson Defendant
10 Demonstrative 230.

11 My understanding is, sir, is that you summed
12 all of the phosphorus that's in the soil in the IRW
13 and came up with 6.4 million tons, and that's what's
14 represented by the yellow portion of this -- I don't
15 know -- pie, for example?

16 A. No, that's not correct.

17 Q. Okay. Would you please explain how I got
18 that wrong?

19 A. I didn't determine all of the phosphorus in
20 the soils of the Illinois River Watershed. I
21 determined the total phosphorus inside Dr. Engel's
22 GLEAMS model as it represented those soils.

23 Q. Okay. And is that then what's shown here on
24 the yellow portion?

25 A. That is -- yes. That's -- it's not that

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1 specific number. It's actually Meagan
2 Smith's -- those slices don't correspond to actual
3 masses. No. Check that.

4 The 99.91 percent does represent the total
5 phosphorus in the soil in Dr. Engel's GLEAMS model
6 expressed as a relative number compared to the --

7 Q. Okay. Now I think we're talking -- I think
8 we're on the same page here, so to speak.

9 A. I just wanted to be clear.

10 Q. Yes. Thank you, sir, for that.

11 So now, the GLEAMS model, you took that.
12 What level of phosphorus; that is, what depth of soil,
13 did you calculate from the GLEAMS model to determine
14 the 6.4 million tons?

15 A. We looked at -- well, the simple answer is --
16 and I'll add detail -- we looked at the phosphorus
17 that Dr. Engel had inside the model.

18 Q. Okay. How deep does that go? How deep is
19 the soil profile?

20 A. Some HRUs have three layers. Some HRUs have
21 five layers. It's complicated because each of the
22 layers has different thicknesses in different HRUs. I
23 believe I had a range in terms of inches of bottom
24 depths in my expert report.

25 Q. Okay. And so how many inches then did you

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1 consider total from the GLEAMS model for phosphorus
2 -- your phosphorus calculation of 6.4 million tons?

3 A. Well, I captured all of it that was there.
4 If in a given HRU the bottom depth was -- in
5 Dr. Engel's model was 20 inches, I went down to 20
6 inches and stopped because his model stopped. If his
7 model went to -- I just stopped at the bottom
8 depth -- depths which were in Dr. Engel's model.

9 Q. Okay. So then I think I'm starting to
10 understand now. So then that represents essentially
11 the equivalent of 99.91 percent if you compare that to
12 all of the other watershed sources from the -- from
13 Engel's model; correct?

14 A. No, that's not correct.

15 Q. Okay. I'm trying to understand where it says
16 here 99.91 percent, that's the soil portion. And what
17 are you comparing it to when you say "all watershed
18 sources," .09 percent?

19 A. Well, that -- those are -- those are the
20 sources that were in the mass balance.

21 Q. Oh, okay.

22 A. The small slice here that says "all watershed
23 sources," those are the sources that Meagan Smith
24 considered entered the watershed --

25 Q. Okay.

1 A. -- in the mass balance.

2 Q. So you're comparing the GLEAMS sources with
3 the mass balance sources?

4 A. Not exactly. They're not the GLEAMS sources.
5 That just happens to be the phosphorus mass reservoir
6 that's in the soil in Dr. Engel's GLEAMS model.
7 That's all that is.

8 Q. Okay. So you agree with me, Dr. Bierman,
9 that not all of the soil phosphorus that's in the
10 GLEAMS model is likely to be a source of phosphorus in
11 the rivers, streams, and lake of the IRW?

12 A. What do you mean by "not likely"? The
13 surface phosphorus is more likely to be a potential
14 source of phosphorus runoff to edge-of-field than is
15 the phosphorus at deeper layers.

16 However, keep in mind that we're not just
17 talking about overland transport here. It's possible
18 for water to infiltrate into the ground, migrate
19 horizontally through the soil horizon, and be
20 delivered to the edge-of-field. The GLEAMS model
21 actually represents both of those kinds of transport.

22 Q. Okay. And so is it your belief, sir, since
23 you did this analysis, that there is such a subsurface
24 transport occurring in the IRW?

25 A. I did not form that opinion. This analysis

10344

1 that I conducted simply consisted of looking at what's
2 in his model and adding up all the boxes and producing
3 that number of 6.4 -- arriving at that number of 6.4
4 million tons.

5 Q. Well, you agree with me, Dr. Bierman, that
6 the most important source of phosphorus for the
7 waters, the surface waters, of the IRW would be the
8 phosphorus that's closest to the surface of the soils?

9 A. As a very broad generality, I -- as a very
10 broad generality, I could agree with it. Whether or
11 not that's the case for the site-specific conditions
12 in this watershed, I have no basis to form an opinion
13 because I didn't conduct that analysis.

14 Q. So you don't know either way on that, but
15 generally that would be correct.

16 Would it also be correct, sir, that anything
17 that's put on top of the land, such as disposal of
18 poultry waste, would also be the most likely source of
19 phosphorus going into the waters of the IRW?

20 MR. GEORGE: I'm sorry. Objection, Your
21 Honor. The witness has just said he didn't do that
22 analysis and hasn't formed an opinion.

23 THE COURT: Sustained. And in that
24 regard, this is captioned as "plaintiff's percentage
25 of annual watershed phosphorus additions."

10345

1 Based upon your testimony, it would appear to
2 more accurate that you're calculating all of the
3 phosphorus contained in the GLEAMS model that may well
4 be banked for a period of years in the soils; right?
5 This isn't necessarily annual watershed phosphorus
6 additions; correct?

7 THE WITNESS: Right. If I may explain.

8 The annual addition that's referred to is the
9 annual addition of phosphorus to the Illinois River
10 Watershed that was taken from Meagan Smith's mass
11 balance report. So that's the new phosphorus. The
12 new phosphorus that's coming into the watershed --
13 this bubble that encompasses the whole watershed,
14 that's the new phosphorus that comes in in one year.
15 And this --

16 THE COURT: And that's what this yellow
17 portion of the pie represents?

18 THE WITNESS: No. Actually, that
19 portion, Your Honor, is just the small slice, the .09
20 percent slice.

21 The whole point here is that what comes
22 in -- what Meagan Smith or what Dr. Engel assumed --
23 the amount of new phosphorus that they assumed comes
24 into the watershed in each year there's a very, very
25 small fraction; in fact, .09 percent of the total

10346

1 phosphorus that is already in Dr. Engel's GLEAMS
2 model.

3 THE COURT: All right. But 99.91
4 percent, according to your calculation of the total
5 phosphorus shown in the model, Engel's model, could be
6 accurately characterized as banked phosphorus?

7 THE WITNESS: Well, it's total
8 phosphorus reservoir, yes. That would be one way to
9 think of it.

10 THE COURT: Go ahead.

11 Q. (BY MR. PAGE) And the sources of that banked
12 phosphorus can be the same sources that are shown here
13 on your demonstrative; that is, that this banked
14 phosphorus could very well have been previous years'
15 contributions as shown from the mass balance analysis?

16 A. Some of that phosphorus certainly is, but a
17 relatively small percentage of it.

18 Q. And what is your basis for that, sir? Did
19 you actually calculate what the background phosphorus
20 levels are in the IRW that would be represented by
21 Dr. Engel's banked phosphorus and compare that to the
22 number you have here?

23 A. Well, I'll tell you what I did.

24 Q. Did you do that, sir? Did you do that
25 analysis?

10347

1 A. I did the analysis that forms the basis for
2 the opinion I just expressed. Would you like me to
3 explain what I did?

4 Q. No. I'd like you to answer my question,
5 Dr. Bierman.

6 A. Please repeat the question, sir.

7 Q. Did you actually compare the amount of banked
8 phosphorus that's in Dr. Engel's model that you came
9 up with, 6.4 million tons --

10 A. Yes.

11 Q. -- to what would be banked if there had been
12 no contributions such as those that have been
13 contributed through the mass balance analysis?

14 A. I did that for poultry litter.

15 Q. And did you do it for the rest?

16 A. No. I -- I went to table 11 in Appendix B of
17 Dr. Engel's expert report, and that table contains his
18 numbers for the amount of poultry P that's been
19 applied in the IRW for the past 50 years. I simply
20 added that number up and I got a number that I believe
21 was about 161,000. I can check it exactly.

22 But that number -- the accumulated total of
23 poultry P application to the land surface in the IRW
24 from Dr. Engel's expert report is approximately .02
25 percent of the total phosphorus reservoir that is

10348

1 sitting there contained in his GLEAMS model.

2 Q. Okay, sir. And the GLEAMS model obviously is
3 not showing that all this phosphorus that you're
4 showing there is going to the river very quickly, is
5 it?

6 A. No. Excuse me, sir. May I correct the
7 record?

8 I think that number was two percent. I said
9 0.2. I think I misspoke.

10 Q. So it's your point, sir, that two percent of
11 the banked phosphorus is from poultry litter; that's
12 your testimony?

13 A. No, sir, that's not what I meant. I'm saying
14 that if one takes the cumulative total of poultry P
15 that has been applied in the IRW for 50 years from
16 Dr. Engel's own expert report, that number happens to
17 be two percent of the total phosphorus reservoir or
18 the total phosphorus that's banked in his GLEAMS
19 model. I'm forming no opinion about transport and
20 fate of that phosphorus.

21 Q. Now, your testimony about the HRUs, sir,
22 earlier today --

23 A. Yes, sir.

24 Q. -- did you perform any tests to determine
25 whether the size of the HRUs used by Dr. Engel were

10349

1 too large to accurately represent nonpoint sources
2 from local sources?

3 A. I didn't need to perform a test --

4 Q. Sir, if you could just answer my question,
5 please. Did you or did you not perform any tests?

6 A. It -- sir, it depends what one means by
7 "test." I consulted the manual that was written by
8 the developers of the GLEAMS model and the developer
9 of the CREAMS model, which shares the same science,
10 and those manuals are very clear as to the size of the
11 field for which CREAMS and GLEAMS were designed for.
12 And then I looked at the sizes of the HRUs that
13 Dr. Engel used in his model and determined that they
14 were orders of magnitude too large.

15 Q. Okay, sir. But you didn't perform any -- you
16 didn't revise the HRUs in Dr. Engel's GLEAMS model and
17 determine whether the size that you're being critical
18 of had any impact on the modeling results, did you,
19 sir?

20 A. I did not conduct any such analysis, sir.

21 Q. I want to talk to you a little bit about the
22 criticism you had about Dr. Engel's use of GLEAMS for
23 the urban characterizations.

24 A. Yes. Yes, sir.

25 Q. Are you testifying, sir, that the GLEAMS

1 model cannot be used to characterize urban areas?

2 A. It's my testimony that the developer stated
3 that it was designed for ag fields of small size, not
4 for urban land. It's also my testimony that the EPA
5 manual which describes these models states
6 specifically that it's intended for ag use, not urban
7 use.

8 Q. And this was your first experience with the
9 GLEAMS model, correct, sir, this case?

10 A. It's my first experience with the GLEAMS
11 model. That doesn't mean I can't read the manual.

12 Q. Okay, sir. And isn't it true, and you
13 would agree with me, that an experienced modeler can
14 make modifications to a model and can add capabilities
15 for it to do something for which it might not have
16 been originally designed?

17 A. As a -- as a hypothetical, sir, I agree with
18 that.

19 Q. Okay, sir. Now, have you performed any
20 scientific investigations relating to urban runoff?

21 A. I investigated the way in which Dr. Engel
22 used the GLEAMS model to represent urban land for the
23 IRW.

24 Q. I'm sorry. My question was somewhat
25 ambiguous.

10351

1 Have you performed any scientific
2 investigations prior to work in this case relating to
3 urban runoff?

4 A. I've done some simple spreadsheet modeling of
5 different land use areas, including urban.

6 Q. But you've never published any of your
7 investigations, or any investigation, concerning urban
8 runoff in a peer-reviewed paper?

9 A. Yes, that's correct.

10 Q. Now, Dr. Bierman, is it your opinion that
11 GLEAMS cannot be used to model urban runoff?

12 A. My opinion is consistent with the developers
13 of the model who stated that it was not designed for
14 that intended purpose.

15 Q. I know you've told me what the model designed
16 purpose was.

17 But my question is, based on your experience
18 as a modeler, can the GLEAMS model be used to model
19 urban runoff?

20 A. Are we speaking of the hydrology, or are we
21 speaking of the nonpoint-source phosphorus runoff?

22 Q. Nonpoint-source phosphorus runoff.

23 A. I don't know if the GLEAMS model, which is
24 designed to be an ag model, can in a scientifically
25 defensible manner be modified to represent

10352

1 nonpoint-source phosphorus runoff. But I do know that
2 the way Dr. Engel used it to represent that runoff in
3 this case was incorrect and was flawed.

4 Q. So just so the record's clear, you don't know
5 whether or not GLEAMS can be used to model nonpoint
6 source nutrient runoff; correct?

7 A. Whether one can do it is one thing. Whether
8 one can do it and have it be done in a scientifically
9 acceptable manner is another question.

10 Q. Dr. Bierman, we'll get through this a little
11 bit faster if you just answer my question. We'll take
12 it stepwise.

13 I first just want to know whether you have an
14 opinion as to whether one can modify the GLEAMS model
15 in order to model urban runoff?

16 A. I suppose. Yes, I suppose one could do
17 that.

18 Q. Okay. Now, let's talk about what your
19 concerns are with Dr. Engel.

20 A. Uh-huh.

21 Q. You mentioned that you were concerned about
22 the crop selection for urban runoff?

23 A. I was concerned -- no, my concern was broader
24 than that.

25 The GLEAMS model -- for each land use type it

10353

1 requires two sets of inputs, one is hydrology and one
2 is nutrients. The nutrient parameter input file that
3 Dr. Engel used for his GLEAMS model was taken from an
4 example in the GLEAMS manual and it represented a crop
5 type of alfalfa hay.

6 Q. Okay. And what was wrong with that?

7 A. Because alfalfa hay doesn't grow
8 in -- doesn't cover the urban land use area in the
9 Illinois River Watershed.

10 Q. Okay. But those language or verbal
11 descriptors aren't all of the variables that are part
12 of the land use aspect of the GLEAMS model, are they,
13 sir? I mean, there's all kinds of different curves
14 and different inputs beyond just the name "alfalfa";
15 correct?

16 A. Yes. And that's precisely the point. This
17 is not just a labeling issue. Because the nutrient
18 input file, it's not just a label that says "alfalfa
19 hay." It contains specifications for phosphorus
20 concentrations, nitrogen concentrations, how
21 phosphorus cycles, how nitrogen cycles, how phosphorus
22 and nitrogen interact.

23 When one makes that designation for urban
24 land, one invokes all of that nutrient cycling, and,
25 sir, that simply doesn't occur in pavements and

1 highways in the Illinois River Watershed.

2 Q. But, the alfalfa -- you can adjust those
3 subparameters, can you not? Those can be adjusted?

4 A. Dr. Engel did not do that in a nutrient
5 parameter input file; he used it straight up.

6 Q. Oh, that's your testimony, sir, he did not
7 make any adjustments in those parameters?

8 A. He did not adjust -- he used the nutrient
9 parameter input file. The adjustments he made, sir,
10 were in the hydrology file.

11 Q. Okay. Isn't the curve number also part of
12 like, for example, soil moisture?

13 A. The curve number is very important for the
14 hydrology, yes.

15 Q. Okay. Did you consider whether or not there
16 were modifications in the hydrology concerning soil
17 moisture content?

18 A. I didn't look at soil moisture content. I
19 looked at curve number, which is very -- far more
20 important.

21 Q. Okay. Well, you can also modify the soil
22 moisture content to make a difference also; is that
23 correct, sir?

24 A. Yes, sir, you can.

25 Q. Did you do any tests; that is, rerun the

10355

1 GLEAMS model, with changes in the assumptions that you
2 claim Dr. Engel made to see if it had any material
3 effect on the model output?

4 A. With the GLEAMS model?

5 Q. Yes, sir.

6 A. No, sir. Dr. Engel made those changes
7 himself.

8 Q. Okay. Now, I just -- Dr. Bierman, please.
9 "Yes" or "no" is fine.

10 A. No, I didn't -- yes.

11 Q. Did you rerun the GLEAMS model to see if it
12 had a material impact?

13 A. No, I did not.

14 Q. Thank you, sir. Now, Dr. Bierman, I remember
15 you raising a concern that Dr. Engel did not calibrate
16 the GLEAMS model to the edge-of-field using the
17 hundred or so samples that he had for edge-of-field.
18 Was that one of your concerns?

19 A. My concern is that yes, he should have
20 compared the output of his GLEAMS model to those
21 data.

22 Q. Is it standard practice in the watershed
23 modeling community to calibrate to the edge-of-field?

24 A. It's standard practice to use the data when
25 they're available.

10356

1 MR. PAGE: Move to strike.

2 Q. (BY MR. PAGE) I asked you a specific
3 question, sir, with regard to the watershed modeling
4 community.

5 THE COURT: Sustained.

6 A. Well, it was standard practice apparently for
7 Dr. Storm because he published a paper in 2007, sir,
8 in which he -- he did three site-specific studies in
9 the Eucha-Spavinaw Watershed right here in Oklahoma
10 where he specifically -- he modeled and measured
11 edge-of-field concentrations and compared his model
12 output to those edge-of-field concentrations.

13 Q. Are you aware of any other published
14 peer-reviewed articles where there's a watershed model
15 where they did a calibration to edge-of-field?

16 A. I'm not personally aware of any peer-reviewed
17 publications save for this work by Dr. Storm.

18 And I might add, sir, that in that paper,
19 he -- part of that he not only did site-specific
20 studies in those three watersheds, but he gathered
21 together data which represented 280-some years of
22 edge-of-field measurements for other locations in the
23 south.

24 MR. PAGE: Your Honor, I move to strike
25 as nonresponsive, the part where he went on to talk

10357

1 about Dr. Storm's analysis.

2 MR. GEORGE: Your Honor, with all due
3 respect, the witness was asked about his understanding
4 of the peer-reviewed literature and he's discussing
5 the subject.

6 THE COURT: Overruled. And also with
7 regard to the last question and answer where the court
8 struck the answer, it did, in fact, appear responsive
9 upon the court's review. The question was, "Is it
10 standard practice in the watershed modeling community
11 to calibrate to the edge-of-field?" The answer was,
12 "It's standard practice to use the data when they're
13 available."

14 That's directly responsive. The court
15 reverses its previous ruling. That's overruled.

16 Go ahead.

17 THE WITNESS: Thank you, sir.

18 Q. (BY MR. PAGE) Dr. Bierman, you did not
19 conduct any independent analysis of potential
20 phosphorus sources in the IRW, did you, sir?

21 A. I conducted no quantitative analysis, no.

22 Q. And you can't tell us, sir, today what the
23 relative contribution of phosphorus sources are within
24 the IRW?

25 A. No, I cannot. I did not conduct that

10358

1 analysis.

2 Q. And did you actually perform a water quality
3 model of the IRW, actually do a water quality model --

4 A. A watershed model?

5 Q. Yes, sir.

6 A. No, sir, I did not.

7 Q. Well, did you do an in-stream model?

8 A. No, sir, I did not.

9 Q. Did you do a lake model for the IRW?

10 A. No, sir. My assignment in this case was to
11 review Dr. Engel's body of work, not to develop my own
12 independent model.

13 Q. And did you do any independent investigation
14 of transport or delivery of phosphorus from poultry
15 litter fields in the IRW to Lake Tenkiller?

16 A. No.

17 Q. Did you or your team perform any sampling or
18 other field investigations, other than a site visit,
19 of the IRW?

20 A. No, we did not.

21 Q. Now I want to talk a little bit about your
22 testimony concerning the land use land cover database.

23 A. Yes, sir.

24 Q. What database did Dr. Engel use?

25 A. My understanding is that he used the national

10359

1 land cover data set.

2 Q. Have you ever used that data set before, sir?

3 A. My staff have used it. I have not personally
4 used it.

5 Q. Is it traditionally the data set that is used
6 for watershed modeling?

7 A. Yes. That's my understanding.

8 Q. So Dr. Engel followed the standard practice
9 when he used for his GLEAMS model the national land
10 cover data set?

11 A. I don't know if he followed standard
12 practice, but he used the same data set that's widely
13 used by others.

14 Q. In fact, your staff uses it when it does
15 watershed modeling; correct?

16 A. Yes, sir, they do.

17 Q. Now, I just want to make sure the record's
18 clear on this.

19 You personally did not do the evaluation of
20 whether or not the land use data was correct from the
21 national land use database; correct?

22 A. Those work products were developed by my
23 staff and I reviewed them but I did not personally
24 conduct the analysis.

25 Q. And, in fact, sir, you don't have any

10360

1 experiencing -- experience -- excuse me, sir -- in
2 interpreting land use to aerial photos, do you, sir?

3 A. I have experience in interpreting land use
4 photos. It's the first time I've ever seen those
5 types of photos. It's not the first time I've ever
6 seen the NLCD -- I've used NLCD data and I've seen and
7 interpreted georeference data.

8 I have knowledge in that area, sir, but I
9 don't consider myself an expert.

10 Q. You don't consider you an expert on aerial
11 interpretation?

12 A. Not as expert as someone with specific formal
13 training in it. I have no formal training in it.

14 Q. Okay. Now, did you do any specific
15 analysis -- these errors that your staff claimed told
16 you that they found, did you do any specific analysis,
17 like rerun the GLEAMS model, to determine whether or
18 not those errors in the national land cover database
19 had a material effect on the GLEAMS output that
20 Dr. Engel performed?

21 A. We did not fix his errors and then -- we
22 didn't -- we -- we discovered errors. This was a
23 concern. I did not fix the errors and rerun the model
24 to determine what quantitative difference that made.
25 No, sir, I did not do that.

10361

1 Q. So you don't know whether it was a material
2 problem or not?

3 A. It depends what one means by "material."
4 When I saw the numbers of mistakes and when I saw the
5 numbers of the inconsistencies -- internal
6 inconsistencies in Dr. Engel's GLEAMS model input
7 files, this is a concern, and it's not just a labeling
8 concern.

9 Q. But you could have tested that by rerunning
10 the model with these changes in the so-called errors;
11 correct? Could you have done that, sir?

12 A. We did run the GLEAMS model. We could run
13 the GLEAMS model.

14 Q. Could you have done it with this data that
15 you claim was erroneous to see if it had a material
16 effect in the output?

17 A. Okay. What I could have done and whether
18 that would have had -- whether that would have helped
19 me to form my opinion about the validity and
20 reliability of Dr. Engel's results are two separate
21 questions, sir. I could have run the GLEAMS model. I
22 could have run the GLEAMS model with different land
23 use classifications.

24 Q. And that wasn't done; correct?

25 A. I didn't do that because my job was not to

10362

1 fix Dr. Engel's mistakes and correct his model.

2 MR. PAGE: Move to strike the last part
3 of his answer, Your Honor.

4 MR. GEORGE: Your Honor, I believe
5 that's directly responsive.

6 THE COURT: Overruled. The answer may
7 stand. Go ahead.

8 Q. (BY MR. PAGE) Have you ever used empirical
9 equations or models in your work, sir?

10 A. Yes, sir, I do.

11 Q. Okay. So it's standard in the modeling
12 community to use empirical equations to describe fate
13 and transport activities?

14 A. It's standard to use empirical equations.

15 It's not standard to use empirical equations to
16 describe transport and fate if what we're speaking
17 about is moving water or moving material from point A
18 to point B through a pathway.

19 Q. So it's your testimony today that Dr. Engel's
20 use of an empirical equation or model for the routing
21 portion of his model is not standard practice?

22 A. The specific routing model that Dr. Engel
23 used in this case and the way he used it to connect
24 his edge-of-field loadings to the loadings at the
25 downstream gauges in the Illinois River Watershed is

1 certainly not standard practice.

2 Q. Well, let's talk about your sensitivity. I
3 think you called it a sensitivity test of the routing
4 model?

5 A. That would be one way to refer to it, yes,
6 sir.

7 Q. Yeah. Now, did you actually run these
8 sensitivity tests or did someone from your staff do
9 this work?

10 A. Both. I ran some and one of my staff ran
11 them as well.

12 Q. All right, sir. Let's -- let's -- you
13 mentioned that you calibrated Dr. Engel's model; is
14 that correct, sir?

15 A. I recalibrated I think was the --

16 Q. You recalibrated. So you changed the model,
17 did you not?

18 A. In my opinion, I didn't change the model; I
19 recalibrated the model.

20 Q. When you recalibrated the model, you changed
21 the routing coefficients, at least some of them, for
22 that model, did you not?

23 A. I changed the coefficients, but in my
24 opinion, that's not changing the model. Because in
25 Dr. Engel's expert report on page D-21, he presents

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1 what he represents as his routing model. The routing
2 model, as represented in his expert report, it doesn't
3 have specific numerical values attached to the
4 coefficients A, B, C, or P accumulation.

5 Q. So it's your testimony, sir, that
6 Dr. Engel -- if you changed the coefficients in
7 Dr. Engel's routing model, it does not change the
8 model?

9 A. It doesn't change the model; it changes the
10 site-specific application of the model.

11 This is what's done every day in
12 environmental modeling. You have a set of equations,
13 these equations have coefficients, and the calibration
14 process consists of applying that model to a site to
15 data and determining the coefficients through
16 calibration.

17 That's what Dr. Engel did in his expert
18 report, and that is exactly what I did, sir, when I
19 conducted my sensitivity analysis.

20 Q. Are you saying you don't know what the
21 coefficients were -- when Dr. Engel calibrated his
22 model, he identified the coefficients for that model,
23 correct, that routing model?

24 A. When he calibrated the model, each time he
25 calibrated it -- and we're speaking of three different

10365

1 versions now -- each time he did that, he ended up
2 with a set of coefficients.

3 Q. But the final version that supported his
4 testimony in this case, he had specific coefficients
5 for that routing model; correct?

6 A. Yes, sir, he did.

7 Q. And then he used independent data, a separate
8 set of data, to check that model's calibration to
9 validate it; correct?

10 A. That's incorrect.

11 Q. Okay. Well, he didn't change the cal -- he
12 calibrated it and then used it for this case. He used
13 the same coefficients then as he did his model
14 predictions; is that correct?

15 A. Okay. I'm taking issue with a different part
16 of your statement, sir.

17 Q. Okay.

18 A. Dr. Engel represented his work as calibration
19 validation. Actually, when he calibrated -- his
20 calibration and validation steps were completely
21 separate for the hydrology portion of his GLEAMS
22 model.

23 Q. Okay. Let me get on to the point here.

24 A. The running model --

25 Q. Let me get on to the point here, sir.

10366

1 MR. McDANIEL: Your Honor, excuse me.

2 If Mr. Page could extend the witness the courtesy of
3 allowing him to finish his answer.

4 THE COURT: Well, he began to -- the
5 objection's sustained.

6 Go ahead and finish.

7 A. Okay. Let me cut back to the routing model,
8 sir. Your question was about the routing model.

9 Before I answer the question you asked, I
10 have to -- one of the premises in your question is not
11 correct and I can't answer the question as asked. So
12 I would have to point out Dr. Engel represented that
13 he calibrated and validated his routing model.

14 Sir, the way you asked the question, you
15 represented it to me as though a calibration step was
16 conducted and then a separate validation step was
17 conducted, but that's not what Dr. Engel did.

18 Q. Let me ask a different question.

19 A. Yes, sir.

20 Q. After Dr. Engel calibrated his model for
21 testimony in this case, he didn't modify the
22 coefficients in the routing model, he maintained them
23 the same way; correct?

24 A. For use in his forecast scenarios, yes, sir,
25 he did.

1 Q. Yes, he did. But when you did these
2 sensitivity analyses, you changed those coefficients,
3 did you not?

4 A. Yes. Because I recalibrated, and therefore,
5 it was the same model with different coefficients. It
6 was a different realization of the same model.

7 Q. Well, if you change the coefficients in a
8 water quality model, that changes the results, does it
9 not?

10 A. It doesn't change the model; it changes the
11 numerical results. It's the same model.

12 MR. PAGE: May I approach, Your Honor?

13 THE COURT: You may.

14 Q. (BY MR. PAGE) Okay. Now, Dr. Bierman, I
15 handed you what's marked as Demonstrative 361.

16 A. Yes, sir.

17 Q. Do you recognize that as being Dr. Engel's
18 routing model?

19 A. Yes. This is how Dr. Engel represented
20 what's on this demonstrative.

21 Q. Okay, sir. And so there's certain
22 coefficients there. There's the A, B, and C
23 coefficients; correct?

24 A. Yes, that's correct.

25 Q. And depending on what numbers you have in

10368

1 those coefficients, that will affect the results;
2 correct?

3 A. That's correct.

4 Q. Okay, sir.

5 MR. PAGE: May I approach, Your Honor?

6 THE COURT: You may.

7 Q. (BY MR. PAGE) Now, Dr. Bierman, I've handed
8 you Demonstrative 362. The top is Dr. Engel's model
9 with the coefficients he used. Do you recognize that,
10 sir?

11 A. I recognize those coefficients as being the
12 coefficients in one of the several versions of his
13 routing model, yes, sir.

14 Q. Well, do you recall whether this is the
15 version he used to testify in court here for his
16 opinions?

17 A. I can't recall specifically which version
18 this is.

19 Q. Okay, sir. And just so we understand here,
20 coefficient A is 0.1; correct?

21 A. Yes, that's correct.

22 MR. GEORGE: Excuse me, Your Honor. I
23 apologize, Mr. Page.

24 There's no foundation for the use of this
25 exhibit. It's not being used as a demonstrative,

10369

1 rather for the truth of the matter asserted, and the
2 witness has not embraced its accuracy. So absent
3 further foundation, I don't believe it can be used in
4 this manner.

5 MR. PAGE: Your Honor, he said he
6 recognized it, at least one of them. I think it's
7 appropriate here for me to test and cross-examine this
8 witness as to what he did in the sensitivity analysis
9 to show the differences between Dr. Engel's model and
10 coefficients and what he used.

11 THE COURT: Well, this is not a document
12 to be used to be admitted into evidence; correct?
13 You're simply using it to demonstrate the different
14 coefficients used by Dr. Engel and Dr. Bierman?

15 MR. PAGE: Yes, sir.

16 THE COURT: Overruled. Go ahead.

17 Q. (BY MR. PAGE) So the .1 in Dr. Engel's model
18 is the coefficient A; correct, sir?

19 A. Yes, that's correct.

20 Q. And for your model using -- for the Baron
21 Fork, just the nonpoint source, what coefficient did
22 you have for coefficient A? Excuse me, sir.

23 A. On this demonstrative, it's 0.1.

24 Q. Do you recall that that was the coefficient
25 you used for the Baron Fork?

10370

1 THE COURT: Let me ask: These
2 coefficients don't differ. Why are we even focusing
3 on those?

4 MR. PAGE: Well, they do, Your Honor. A
5 does not differ, but B and C do substantially.

6 THE COURT: Why are we spending time on
7 the coefficients that don't differ, Mr. Page?

8 MR. PAGE: I apologize, Your Honor.

9 THE COURT: Let's move on.

10 Q. (BY MR. PAGE) Okay. Let's look at
11 coefficient B, sir.

12 A. Yes, sir.

13 Q. Is there a difference between the coefficient
14 that Dr. Engel's model used and the one that you used?

15 A. I don't know for certain. These coefficients
16 are different on this piece of paper but, as I
17 mentioned, I can't recall sitting here. I did this
18 analysis a year ago, and I can't recall exactly what
19 the numbers were that he used or I used. They look
20 close but I can't swear that they're the same
21 numbers.

22 MR. PAGE: May I approach, Your Honor?

23 THE COURT: Yes, please.

24 Q. (BY MR. PAGE) Dr. Bierman, I've handed you
25 what's marked as Demonstrative 365. Do you recognize

10371

1 this as a screenshot from your Baron Fork routing
2 model where you made a change in the nonpoint source?

3 A. I recognize it as a screenshot of Dr. Engel's
4 routing model. If the title is correct, it is a
5 screenshot from the routing model -- the sensitivity
6 analysis that I conducted, yes, sir.

7 Q. Okay. And did you see on there, sir, that
8 for the B and C -- under column O for B and C, your
9 coefficients are the same as we find on Demonstrative
10 362; that is, four times ten to the minus 13 for B?

11 A. Yes.

12 Q. And 1.2 times 10 to the minus 12 for C?

13 A. What's on Demonstrative 365 does, in fact,
14 match what's on Demonstrative 362, yes, sir.

15 Q. Okay, sir. And so are you saying that it
16 does not refresh your recollection as that being your
17 actual changes that you made in Dr. Engel's equation
18 when you did the sensitivity analysis for nonpoint
19 source?

20 A. I'm sorry, sir. Please repeat the question.

21 Q. Well, I'm just trying to determine whether
22 you recall your own sensitivity analysis and whether
23 or not these are the changes that you made in
24 Dr. Engel's coefficients for B and C.

25 A. I've already testified that when I

10372

1 recalibrated, the recalibration resulted in different
2 values for the coefficients A, B, C, and P
3 accumulation. Whether these are those specific
4 coefficients, I'm not sure. But yes, sir, I changed
5 the coefficients.

6 Q. And so isn't it --

7 A. Excuse me, sir.

8 Q. I'm sorry. Isn't it true, sir, that when you
9 changed these coefficients, you created a different
10 routing model?

11 A. I disagree with that opinion. It's the same
12 model but the -- it's a different calibration of the
13 same model. I guess we can get hung up on semantics
14 here.

15 So the terms -- I will concede that my
16 coefficients are different. I should also point out
17 that Dr. Engel during his deposition stated that these
18 coefficients have no physical meaning and there were
19 no constraints on what values they could take when he
20 calibrated the model.

21 Q. Dr. Bierman, isn't your routing model really
22 different because Dr. Engel's routing model and his
23 coefficients were created based on empirical
24 observations in the IRW, and your routing model
25 coefficients are based on a hypothetical increase of

10373

1 100 times the phosphorus in GLEAMS?

2 MR. GEORGE: Objection, Your Honor.

3 Asked and answered. We've been around the tree
4 several times on whether Dr. Bierman believes this is
5 a different routing model. I believe he made it clear
6 on that.

7 THE COURT: I believe this is a
8 different question. Overruled.

9 Go ahead.

10 A. Please repeat the question, sir. I lost
11 track.

12 Q. (BY MR. PAGE) Isn't it different, because
13 Dr. Engel's routing model, his coefficients, were
14 created based on an empirical observations in the IRW
15 and your routing model coefficients are based on a
16 hypothetical increase of a hundred-fold phosphorus in
17 GLEAMS?

18 A. I'm not sure I would -- I agree with your
19 representation of the inputs. But certainly my inputs
20 were different than his inputs and the coefficients
21 were different -- my coefficients were different than
22 his.

23 Q. And your inputs for phosphorus were
24 substantially greater; correct?

25 A. Yes, sir, they were.

1 Q. But you assumed that the loading; that is,
2 the observed loadings, would be the same when you did
3 your recalibration?

4 A. I calibrated to the same -- I calibrated to
5 Dr. Engel's observed loads which were the same
6 calibration targets he used.

7 Q. Does it make sense to you, sir, that if you
8 increase the nonpoint-source loading of 100 or 18 or
9 how many times you did it, that you'd have the same
10 phosphorus going into the lake? Does that make sense
11 to you, sir?

12 A. That doesn't make sense and that's precisely
13 the point. Because one could put loadings that were
14 unrealistically high, one could put numbers into
15 Dr. Engel's routing model, and still get the same
16 results. Those fictitious loads would still
17 correspond to what went in the lake.

18 Q. You only get the same results, Dr. Bierman,
19 if you change the coefficients and retain more
20 phosphorus in the river by changing those coefficients
21 as you did; isn't that correct?

22 A. No, that's not correct.

23 Q. Well, let's just test that, sir.

24 MR. PAGE: May I approach?

25 A. Sir, I did test it. You asked me the

10375

1 question, would things change. I tried -- I tried --
2 I did two analyses. I redid the reversed order
3 analysis and I put the S & P 500 numbers back into
4 Dr. Engel's routing model with the same equations and
5 exactly the same coefficients and I got exactly the
6 same results.

7 Q. (BY MR. PAGE) Okay. Well, in the nonpoint
8 source example here, sir, that we're talking about,
9 when you put in your change in inputs --

10 A. Yes.

11 Q. -- you made changes in the routing model, you
12 said you recalibrated. Did you ever run those
13 additional inputs, nonpoint source or
14 wastewater-treatment plant, with the same
15 coefficients; that is, the same model, that Dr. Engel
16 had to see what the results would be?

17 A. Not for those, but I did for the S & P 500,
18 sir. I got calibration results which were just as
19 good as the calibration results in Dr. Engel's expert
20 report. I also did so, sir, for the sensitivity
21 analyses where I reversed the order of the loads from
22 first day to last day, and I got the same results when
23 I did that with the same coefficients and the same
24 equation.

25 Q. Is it your testimony, sir, that you used the

10376

1 same exact coefficients in the same routing model when
2 you did the S & P loadings for Dr. Engel's model?

3 A. Not in my expert report, sir. You just asked
4 me, though -- you asked me that if I put different
5 loads into the model with the same equation and same
6 coefficients, would I get the same results, would I
7 expect different results? And I said, no, I tried
8 that and I got exactly the same results.

9 Q. That's not part of your expert report?

10 A. No, sir. It was an answer to your question.

11 Q. So you never gave that opinion in your expert
12 report? You never provided that analysis as part of
13 your expert report?

14 A. That's correct, that is not in my expert
15 report. I simply answered your question, sir. The
16 reason I did that was because in the Daubert motion, I
17 was surprised when Dr. Engel expressed --

18 Q. I think you've answered my question. Thank
19 you, sir.

20 A. Thank you, sir.

21 MR. PAGE: May I approach, Your Honor?

22 THE COURT: You may.

23 Q. (BY MR. PAGE) Now, Dr. Bierman, I've
24 provided you Demonstrative 363. What I've shown here
25 is, we ran your routing model with your inputs but

10377

1 didn't hold the same observed amount.

2 A. Excuse me?

3 Q. Did not use the same observed numbers. We
4 just ran the model with your routing model, used your
5 inputs and ran the model, and the upper numbers are
6 what we came up with.

7 Now, sir, does it surprise you --

8 MR. GEORGE: I'm sorry, Mr. Page. Your
9 Honor, it's a little unclear to me, but I believe the
10 demonstrative is apparently the work product of maybe
11 Dr. Engel that has been done outside of the confines
12 of his direct testimony, files that have not been
13 produced in this case. There's simply no foundation.

14 This is not a demonstrative exhibit. It's
15 not an impeachment. It's Mr. Page seeking to get in
16 some analysis who's done by an expert who's not here
17 to testify to.

18 THE COURT: Sustained. Now, let me ask,
19 because all of this raises the distinct possibility
20 that I need to hire a special master to compare these
21 two and to make you all pay for it frankly, but do I
22 understand that with regard to the S & P analysis that
23 you did in reversing the times, that you did so in
24 your report using the different coefficients and not
25 the same coefficients as Dr. Engel did?

1 THE WITNESS: Yes, sir, that's what I
2 did.

3 THE COURT: And why is that? I don't
4 understand that. Why did you change the coefficients?
5 And I understand your distinction between the model
6 and the coefficients. But if you want to compare
7 apples to apples, why didn't you keep the coefficients
8 the same?

9 THE WITNESS: The objective was, to
10 answer the question, could the model be recalibrated
11 to connect Dr. Engel's loads from the watershed to the
12 observed loads? So the purpose was to see if I could
13 calibrate it with loads that made no sense.

14 THE COURT: And you did that because
15 Dr. Engel was recalibrating; is that correct?

16 THE WITNESS: Well, when Dr. Engel
17 developed his model initially, he calibrated to
18 observed data.

19 THE COURT: Yes.

20 THE WITNESS: I simply repeated that
21 same exact process. I --

22 THE COURT: Observed data at the three
23 locations below?

24 THE WITNESS: Observed data at three
25 locations.

1 THE COURT: All right. So you simply,
2 in your view, did the same thing he did, recalibrated
3 using different data?

4 THE WITNESS: Yes, sir. And that's the
5 whole point of my analysis, is that he did his
6 calibration with his phosphorus inputs and got a match
7 and said he got a good fit. I put very wildly
8 unrealistically numbers in and still got a good
9 match.

10 THE COURT: And you believed you were
11 free to alter the coefficients because that was part,
12 in your view, of Dr. Engel's model because he felt
13 free to alter the coefficients; is that a fair
14 layman's observation?

15 THE WITNESS: It is, sir. We both
16 calibrated the same model. He calibrated his and I
17 calibrated his.

18 THE COURT: Now that I'm kind of on the
19 same page, maybe we can avoid a special master.

20 Go ahead.

21 MR. PAGE: I don't know, Your Honor.
22 We'll see.

23 Q. (BY MR. PAGE) Dr. Bierman, isn't it true,
24 though, that when you multiply -- listed a nonpoint
25 source by a hundred times, or the wastewater-treatment

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1 plant, it was unrealistic then to use the one percent
2 or the one-time wastewater-treatment plant observed
3 loads to calibrate your model? Because you knew when
4 you did your calibration that you've increased the
5 phosphorus loading to the system a hundred-fold, yet
6 you used the observed data that was actually going on
7 in the IRW?

8 A. No. Because that wasn't the point of my
9 analysis. My analysis did not consist of computing
10 phosphorus loads to Lake Tenkiller. My analysis
11 consisted of simply reconducting Dr. Engel's own
12 calibration with his own model.

13 Q. No. Because his model had the GLEAMS input
14 and the actual wastewater-treatment plant phosphorus
15 input and then he calibrated based on observed. Your
16 model increased those by a hundred-fold, changed the
17 coefficients, so you could match the observed.

18 That isn't the same analysis, is it, sir?

19 MR. MCDANIEL: Object. It's compound,
20 it's argumentative, and it assumes facts not in
21 evidence.

22 THE COURT: Well, I need the
23 argumentation frankly on this subject to go on because
24 I need this dialogue. It is -- I don't think it's
25 unfairly compound. Overruled.

10381

1 Go ahead.

2 MR. GEORGE: Your Honor, may I request
3 that the exhibit that the court has sustained the
4 objection on be taken off the screen?

5 THE COURT: Oh, yes. Absolutely.

6 Do you remember the question?

7 THE WITNESS: No, sir, not at this
8 point.

9 THE COURT: Okay. I guess you're going
10 to have to rephrase by necessity.

11 MR. PAGE: I'll do my best, Your Honor.

12 *(Discussion held off the record)*

13 Q. (BY MR. PAGE) Dr. Bierman, isn't it true,
14 though, when you multiply by the nonpoint source by a
15 hundred times; that is, the input, and the
16 wastewater-treatment plant by a similar amount, it was
17 unrealistic then to use the one percent or the
18 one -- the basis of one for wastewater-treatment plant
19 observed loads when you did your analysis? That is,
20 was it reasonable for you to assume that the observed
21 loads would remain the same if you increased the
22 phosphorus inputs a hundred-fold?

23 A. First of all, that's not exactly what I did;
24 I didn't increase. I increased nonpoint source 15
25 times and wastewater-treatment plant 345 times. What

10382

1 I did was completely consistent with the purpose of my
2 test.

3 The purpose of my test was not to compute
4 loads to Lake Tenkiller. My purpose was not to
5 develop a new model. My purpose was to ask a very,
6 very simple question. Could the model that Dr. Engel
7 developed and applied and calibrated, could that model
8 also be calibrated for loads that don't make sense?

9 And if it -- what I expected to see was that
10 the model simply can't be calibrated to loads that
11 made sense. But the model, given its conceptual
12 construction and the way he set it up, it was able to
13 be calibrated. And, sir, I did so in a way that was
14 exactly consistent with how Dr. Engel explained he did
15 his calibration in his deposition.

16 Q. If you had used Dr. Engel's routing model --

17 A. Yes, sir.

18 Q. -- and used the 345-time
19 wastewater-treatment plant inputs --

20 A. Yes, sir.

21 Q. -- would you expect to see his model then
22 show much greater loading into Lake Tenkiller?

23 A. I don't know because I didn't do that. But I
24 did it for the S & P 500 --

25 Q. Just please just stick to the answer.

1 And if you had increased nonpoint source 15
2 times, as you said you did, and used Dr. Engel's
3 routing model, wouldn't you expect it to have an
4 increase in the loading to Lake Tenkiller?

5 A. I actually don't know what to expect.

6 Frankly -- well, let me answer it two ways.

7 My analyses did not, sir, involve computing
8 phosphorus loads to Lake Tenkiller. At no point did I
9 use that model to compute loads to Lake Tenkiller. I
10 was simply trying to determine could I or could I not
11 calibrate it to real data with loads that made no
12 sense? And I showed that it could be calibrated to
13 real data with loads that made no sense.

14 Q. So --

15 A. And that tells me the model is fundamentally
16 and conceptually flawed.

17 Q. So when you did that calibration, where do
18 you suppose that extra phosphorus went? When you
19 recalibrated, based on observed loads, and multiplied
20 the point source by a hundred-fold -- excuse me --
21 345-fold and the nonpoint source by 15-fold, where did
22 that phosphorus go?

23 A. It didn't go anywhere in this model, sir.
24 This is not a mass balance model; it's simply an
25 empirical equation. I don't know where it went.

1 Q. So didn't it end up as retained phosphorus in
2 the river?

3 A. I don't know.

4 MR. PAGE: May I approach, Your Honor?

5 THE COURT: Yes, sir.

6 Q. (*BY MR. PAGE*) Now, Dr. Bierman, I've handed
7 you Demonstrative 366, which is another screenshot
8 from this scenario, this nonpoint source Baron Fork
9 scenario. So 365 is a screenshot from your considered
10 materials, and you see there under 365 first where it
11 shows column M?

12 A. I'm sorry, sir. 365?

13 Q. Yes, start at 365. And then 366 is a
14 continuation of this column as it goes down.

15 MR. GEORGE: I'm sorry, Mr. Page. I
16 only have 366.

17 MR. PAGE: Well, I think I earlier
18 handed you 365, Mr. George.

19 MR. GEORGE: I'm sorry. My mistake.

20 A. Yes, sir. Okay. I'm with you now.

21 Q. (*BY MR. PAGE*) We have to look at these
22 together, 365 and 366.

23 Column M is the LOADEST P accumulation;
24 correct?

25 A. I don't know what --

1 Q. Do you see under Baron Fork Creek on 365 --

2 A. Yes.

3 Q. This is your work product; correct, sir?

4 A. It's my -- it's the results of my sensitivity
5 analyses with Dr. Engel's model, not my model.

6 Q. Okay.

7 A. And, sir, column M is P accumulation, but
8 that has absolutely nothing to do with LOADEST.

9 Q. Okay. So that's your P accumulation. So
10 that means that's the phosphorus has accumulated in
11 Baron Fork at that point in time in the model run;
12 correct?

13 A. Within the framework of Dr. Engel's routing
14 model, yes, sir, that's exactly what it is.

15 Q. Okay. And it corresponds with page --
16 Demonstrative 362 that you showed your starting P
17 accumulation of 20,000 kilograms? Do you see that,
18 sir?

19 A. Yes, I do.

20 Q. Okay. Now, look now with me on 365, as you
21 complete the model on your sensitivity analysis --

22 A. Yes.

23 Q. -- at the bottom, line 3291, what is the
24 total accumulation of phosphorus in the Barron Fork
25 Creek after this ten-year period?

1 A. Oh, okay. It's the -- it's a lot of numbers
2 588964733.1. That's the phosphorus accumulation in
3 the model at the end of the run, and if the phosphorus
4 went anywhere, that's the only place it could go.

5 Q. It's accumulated in the river?

6 A. Not really. Because Dr. Engel's routing
7 model doesn't represent anything physical. I'm not
8 sure where it is. It's in that term.

9 Q. Well, that's the -- that's the difference.
10 Do you know what Dr. Engel's accumulation was after
11 ten years?

12 A. No, I don't know. But if I had the
13 spreadsheet and did this analysis, I could figure it
14 out. I don't know --

15 Q. But in order to calibrate this model, like
16 you said you could calibrate it, you had to force 588
17 million kilograms of phosphorus to be retained in the
18 Barron Fork -- or at least some point between the
19 edge-of-field and Lake Tenkiller and the Barron Fork
20 in order to make that calibrate; correct?

21 A. Yes. And, you know, that's not consistent
22 with Dr. Engel's model. He told us these
23 coefficients, sir, have no physical meaning.

24 Q. And, Dr. Bierman, does it make sense to you
25 that that kind of a calibration would make

10387

1 sense -- does that type of calibration make sense to
2 you, that you'd retain 589 million kilograms of
3 phosphorus in the system based on your hypothetical?

4 A. I actually don't know how much P is
5 accumulated in the IRW so I don't know whether -- I
6 have no basis for forming an opinion, sir, on whether
7 that number is reasonable or unreasonable.

8 I do have a basis for forming an opinion that
9 if one puts all that into Dr. Engel's routing model,
10 it still achieves an excellent calibration as measured
11 by an R^2 . That, sir, is what doesn't make sense to
12 me.

13 Q. Dr. Bierman, do you recall your testimony
14 concerning temperature in the lake and your concerns
15 about variances in that regard?

16 A. Actually, I do not, sir.

17 Q. Do you recall when you said you were
18 reviewing Dr. Wells' model, that you reran it and you
19 found that there was some variations in temperature in
20 the model and you found that was important because of
21 Dr. Cooke's and Dr. Welch's opinions concerning the
22 dissolved oxygen temperature squeeze in the lake?

23 A. I can't recall that testimony, sir. I recall
24 testimony today, of course, pertaining to temperature
25 discrepancies and the replication issue, but I can't

1 recall the testimony pertaining to Dr. Welch and
2 Dr. Cooke.

3 Q. Am I mistaken, sir, that you didn't link that
4 then to question -- because of those potential
5 discrepancies you said you've observed in Dr. Wells'
6 model, that you didn't link that to somehow
7 undermining Dr. Cooke's and Welch's opinion concerning
8 the habitat available for fish in the lake?

9 A. I understand the question now, sir. I meant
10 to form no opinion whatsoever on Dr. Welch's work. I
11 was simply pointing out that the replication problem
12 with Dr. Wells' model resulted in discrepancies of
13 perhaps one- to two-tenths of a degree "centimeter,"
14 and that if that -- if temperature was an important
15 output that one wanted to investigate from that water
16 quality model, such as, for example, the temperature
17 oxygen squeeze, then such a discrepancy could be
18 significant.

19 But I did no such investigation of those
20 impacts on Dr. Cooke or Welch's work and am forming no
21 opinion on their work.

22 Q. Well, regardless of whether or not you're
23 correct about the problem with the temperature
24 predictions of Dr. Wells' model, isn't it true, sir,
25 that Dr. Welch and Cooke based their opinion

10389

1 concerning the temperature squeeze and DO squeeze
2 based on actual observed data in the lake?

3 A. Are you asking me to recall my understanding
4 of what they did?

5 Q. Well --

6 A. Yes. Let me answer it this way.

7 My understanding, based on my recollection,
8 is that they did use data for temperature and
9 dissolved oxygen to determine the habitat volume in
10 the lake. However, I do know for a fact that they
11 used the predictions from Dr. Wells' model for the
12 future scenarios.

13 To the extent that they made predictions as
14 to how that habitat volume would change in the future
15 using the results from Dr. Wells' model, then those
16 temperature discrepancies could have played into those
17 results, could have played into that. In what way? I
18 don't know because I didn't investigate it.

19 Q. So you don't know -- even if you're
20 correct -- and that's assuming you were correct that
21 there was some variations -- you don't know whether it
22 had a material impact on the temperature predictions
23 in the future?

24 A. Well, just to be clear, sir, my opinion is
25 that there were discrepancies. I've documented those

10390

1 discrepancies, they're in my produced materials, but I
2 have no opinion whatsoever as to their impact or lack
3 of impact on Dr. Welch's work or Dr. Cooke's work --
4 excuse me -- except as -- I'm sorry. That was
5 incorrect.

6 In my opinion, the replication flaw in
7 Dr. Wells' model, one of the things it impacted was
8 temperature. I documented that. Now, what that means
9 to me is that any calculation -- any predictions that
10 Dr. Wells made with that model pertaining to
11 temperature would have been similarly flawed.

12 And to the extent that Dr. Welch or Dr. Cooke
13 used those flawed results, then any opinions that they
14 formed based on those results would also be flawed.

15 Q. Did you run the model to determine whether
16 there would be any material difference in the future
17 predictions concerning the lake temperature if, in
18 fact, you're correct? That is, do you have any
19 opinion as to materiality of the change in water
20 temperature?

21 A. You'd have to define "material," sir. I just
22 stated that there were discrepancies. They're on the
23 order of one to two percent. They're on the order of
24 a few tenths of a degree "centimeter" -- excuse me --
25 centigrade, and that's what I know.

1 Q. Just a few tenths of a degree centigrade?

2 A. On average. It was one- to two-tenths of a
3 degree centigrade on average, some were higher, some
4 were lower. It depends on time and space in the lake.

5 Q. Dr. Bierman, I want to talk to you now about
6 when you said you corrected or evaluated the loading.
7 I think it was Exhibit -- the first exhibit on this
8 was Defendants' Joint Exhibit 2413.

9 (Discussion held off the record)

10 Q. (BY MR. PAGE) Tab 11.

11 A. Yes, I have it.

12 Q. Okay. Now, help me understand, sir, exactly
13 what you assumed. That is, what did you assume was
14 the LOADEST model that was used? Or what LOADEST
15 model did you use to compare Dr. Engel's observed
16 loads that he calculated to the ones that you
17 recalculated?

18 A. Well, I used LOADEST model 8. And I didn't
19 have to assume anything because it was clear from
20 Dr. Engel's produced materials that that's the method
21 he used.

22 Q. Didn't Dr. Engel do more than one calculation
23 as part of his considered materials?

24 A. You'd have to define "calculation."

25 Q. Well, more than one calculation of observed

1 loads as he got additional data.

2 A. I don't recall that he did that for his
3 calibration and purported validation period for his
4 GLEAMS and routing models.

5 Q. And you used model 8 every year for your work
6 on 2413; is that correct, sir. That is, USGS LOADEST
7 model 8 for each year?

8 A. Not exactly. Dr. Engel -- I did exactly what
9 Dr. Engel said he did, and what he said he did he said
10 that he did used the approach by -- it was either
11 Tortorelli, et al., or Pickup and Tortorelli. They
12 are scientists who work for the USGS, they employed
13 LOADEST, and they used -- they applied the model in
14 terms of three-year increments and selected the middle
15 year and it was a rolling three-year period of time.

16 Q. What I want you to tell me, Doctor, please,
17 is what LOADEST model. I think on your direct
18 testimony you said you used LOADEST model No. 8.

19 A. Yes, sir, LOADEST model No. 8.

20 Q. Did you use that every year, for 1998 through
21 2006, when you did these calculations?

22 A. I'm sorry, sir. There's two parts to your
23 question. We used the LOADEST model for rolling
24 three-year periods of time, LOADEST model 8, and then
25 selected the middle year for insertion into the table

1 I had. And that is exactly what Pickup, et al., and
2 Tortorelli, et al., did, and that's what Dr. Engel
3 said he did.

4 Q. So isn't it true, sir, that Pickup and
5 Tortorelli actually used several different models, and
6 then in addition LOADEST model No. 8, and then picked
7 which one had the best fit and used that data each
8 year?

9 A. They tried several different models, but the
10 model that Dr. Engel used consistently was LOADEST 8.
11 He said he used the approach by Tortorelli and Pickup,
12 and I took that approach to mean the three
13 years -- well, I didn't have to guess, Mr. Page,
14 because it was clear from Dr. Engel's considered
15 materials what he did and I did the same thing.

16 Q. So you'd be surprised to hear, sir, that
17 Dr. Engel did use Tortorelli's analysis and Pickup and
18 that he used the same model that had the best fit for
19 each year and that didn't always include model No. 8?

20 MR. GEORGE: Objection, Your Honor;
21 assumes facts not in evidence.

22 A. Sir --

23 THE COURT: Just one second. A response
24 here?

25 MR. PAGE: Your Honor, he's made an

10394

1 assumption and testified --

2 THE COURT: I understand. But to go to
3 the objection here, do we have in evidence here
4 specifically what model was used?

5 MR. PAGE: We have Dr. Engel's testimony
6 that said he followed USGS procedures. And I believe,
7 Your Honor -- there's been a lot of documents -- but I
8 believe both Tortorelli and Pickup have been admitted
9 into evidence and they used different models.

10 THE COURT: All right. But there's some
11 ambiguity here insofar as if Tortorelli, if that's the
12 correct --

13 MR. PAGE: You're probably pronouncing
14 it right.

15 THE COURT: -- pronunciation -- I don't
16 know -- but if he used a rolling three-year, I mean,
17 the ambiguity is whether or not he used and hence
18 here -- is this Engel, yeah -- whether Engel used that
19 same three-year as opposed to version 8.

20 MR. PAGE: Yes, sir.

21 THE COURT: All right. Can we resolve
22 this easily?

23 MR. GEORGE: I don't believe we can,
24 Your Honor. Because Mr. Page's representation was
25 with respect to what Dr. Engel did, and there is no

10395

1 evidence in the record as to amongst the options
2 available of Tortorelli whether he went one direction
3 or another.

4 This witness is the only witness who can
5 testify as to the files show. And now Mr. Page is
6 making representations to --

7 THE COURT: All right. Without more,
8 the objection is sustained.

9 Go ahead.

10 Q. (BY MR. PAGE) What's your basis for saying
11 that Dr. Engel used model 8 each year when he did his
12 observed loads?

13 A. Well, you keep saying "each year."

14 Q. Well, but he finally --

15 A. From his considered -- from -- I'm trying to
16 answer the question, sir. From his considered
17 materials, I reviewed his analysis and he used LOADEST
18 model 8 for rolling three-year periods and then he
19 selected the middle year.

20 And if I may volunteer a clarification, the
21 LOADEST model 8 and the three-year rolling average are
22 two different things. They're not different models.
23 I'm sorry.

24 Q. I understand that. That's what I'm trying to
25 get to.

10396

1 THE COURT: I didn't. I appreciated
2 that.

3 Go ahead. Because I thought perhaps there
4 were other LOADEST models that were applicable to the
5 middle year that might have fit those -- the middle
6 year.

7 THE WITNESS: No, Your Honor.

8 THE COURT: So go ahead, Mr. Page.

9 Q. (*BY MR. PAGE*) There other LOADEST models
10 that were used by the USGS during this time period;
11 correct?

12 A. That's my recollection, yes.

13 Q. So if Dr. Engel --

14 THE COURT: Excuse me, Mr. Page. All
15 telephone equipment needs to be turned off in the
16 courtroom. And please -- I hate to have to repeat
17 myself -- but when you come into the courtroom, shut
18 them off.

19 Go ahead, Mr. Page.

20 MR. PAGE: Thank you, Your Honor.

21 THE COURT: And from henceforth, I'm
22 going to have the marshal take those phones from
23 anybody who continues to violate that. I just have
24 to.

25 Go ahead, Mr. Page.

1 MR. PAGE: Thank you, sir.

2 Q. (BY MR. PAGE) It is true, sir, that model 8
3 wasn't the only LOADEST model that USGS used when they
4 did the IRW data that's reflected from 1998 to 2006?

5 A. I believe that's correct, sir. I was not
6 trying to replicate what the USGS did. I was trying
7 to understand what Dr. Engel did and to do what he
8 said he did.

9 Q. And so you -- Dr. Engel testified that he
10 followed the same USGS modeling approach as Tortorelli
11 and Pickup did; correct?

12 A. You know, sir, he said that, but he did not
13 say it with enough specificity for anyone -- in his
14 expert report for anyone to be certain about exactly
15 what he did.

16 Q. So if, in fact, with more specificity we know
17 that Dr. Engel did follow the Tortorelli and Pickup
18 and used two different models, model 8 plus another
19 model, then what you reproduced here isn't exactly
20 what Dr. Engel produced for his observed data;
21 correct?

22 A. I hate to ask this again, sir. Please repeat
23 the question.

24 MR. PAGE: Brian, can you help me out
25 here? Thank you.

10398

1 *(The record was read as requested)*

2 A. The only answer I can give is that my
3 intention was to do what Dr. Engel said he did. And
4 if, in fact, I did what he said he did, my results are
5 correct. If Dr. Engel said he did one thing and did
6 something else, then there are going to be grounds for
7 discrepancies, and I can't sit here now, sir, and
8 eliminate that possibility.

9 Q. *(BY MR. PAGE)* So it's possible you
10 misunderstood what Dr. Engel did for observed data?

11 A. I wouldn't characterize it that way, sir.
12 His documentation for what he did was simply not
13 specific to the level of detail at which you're asking
14 me these questions.

15 So what I had to do was to review his body of
16 work, which was extremely difficult, because it
17 was -- there were multiple files, multiple versions,
18 multiple data errors, and quite frankly it was
19 difficult to navigate my way through exactly what he
20 did and to attempt to reproduce and use the exact same
21 methods that he said he used.

22 *(Discussion held off the record)*

23 Q. *(BY MR. PAGE)* Now, was it your testimony,
24 sir, that Dr. Wells because he used Dr. Engel's SRP
25 data -- excuse me -- Dr. Engel's soluble phosphorus

10399

1 data, that that caused a problem in Dr. Wells' model?

2 A. I'm saying, just to be clear, the loads that
3 Dr. Engel determined that he represented to Dr.

4 -- the loads for which should have been
5 soluble-reactive phosphorus that should have been
6 given to Dr. Wells were in error, Dr. Engel provided
7 soluble phosphorus loads, and yes, that caused a
8 problem -- would have -- that did cause a problem in
9 Dr. Wells' model.

10 Q. Isn't it true, sir, that Dr. Wells used a
11 regression equation to determine soluble-reactive
12 phosphorus from total phosphorus? He did not, in
13 fact, use the soluble-reactive phosphorus information
14 from Dr. Engel?

15 A. That's not completely correct, and I'll
16 explain why.

17 Dr. Wells did, in fact, conduct a regression
18 between total phosphorus and soluble-reactive
19 phosphorus. But he did not, sir, use the results of
20 that regression for his model calibration. Dr. Engel
21 gave him loads that Dr. Engel represented as total
22 phosphorus and soluble-reactive phosphorus so
23 Dr. Wells could calibrate his model.

24 Then -- please let me finish, sir -- then
25 because Dr. Engel's model only predicted total

10400

1 phosphorus and not soluble-reactive phosphorus, when
2 Dr. Wells went to use his model for 50-year prediction
3 simulations all he had from Dr. Engel was total
4 phosphorus. So he had to estimate or derive
5 soluble-reactive phosphorus because Dr. Wells' model
6 needs both total phosphorus and soluble-reactive
7 phosphorus in order to run.

8 Therefore, Dr. Wells needed some way to come
9 up with soluble-reactive phosphorus or else he could
10 not have done any of his predictive simulations. And
11 what he did, sir, was exactly what you said he did.
12 He regressed total phosphorus data to soluble-reactive
13 phosphorus data for the data that he had, and he used
14 the relationship that he developed between total
15 phosphorus and soluble phosphorus to specify
16 soluble-reactive phosphorus loads for his model in all
17 of his predictions. That's exactly what Dr. Wells
18 did.

19 Q. Is it your testimony, Dr. Bierman, that the
20 see CE-QUAL-W2 model that Dr. Wells used used total P
21 measurements directly into his model?

22 A. No, that's not how it works. What happens
23 is --

24 Q. That's -- you answered my question. Thank
25 you.

10401

1 Do you know how Dr. Wells used total P for
2 his model?

3 A. I read what he said he did in his report.

4 Q. And that was just to calculate the forms of
5 organic matter and the associated P with organic
6 matter; is that correct?

7 A. Okay. Let's back up. Dr. Wells' CE-QUAL-W2
8 model of Lake Tenkiller requires total phosphorus
9 loads and it requires soluble-reactive phosphorus
10 loads. However, the model's far more sophisticated
11 than just -- the model contains more than just those
12 two forms of phosphorus.

13 What the model really needs to operate is not
14 just total P and not just SRP and not just the
15 difference between the two, but there are organic and
16 inorganic forms and dissolved and particulate forms of
17 phosphorus. There are six or eight different forms of
18 phosphorus that that model requires to run.

19 What Dr. Wells did is he took the phosphorus
20 loads from Dr. Engel, the soluble-reactive phosphorus
21 loads from Dr. Engel, and he used available data for
22 the incoming tributaries and he used that information
23 to apportion his total phosphorus inputs into the
24 components that were required by the CE-QUAL model.

25 Q. Isn't it true, sir, that Dr. Wells used the

10402

1 regression analysis from the total phosphorus data to
2 determine SRP and then he used actual observed data to
3 fill data gaps?

4 A. Dr. Wells implemented in the tributary
5 loading estimation field -- that's referred to as data
6 substitution -- and what Dr. Wells -- I testified as
7 to how Dr. Engel used the wrong form of phosphorus --
8 total phosphorus instead of soluble-reactive
9 phosphorus, and he passed these forward to Dr. Wells
10 to use in his model.

11 Now, Dr. Wells did not use all of that
12 information directly as provided.

13 Q. Did you -- I'm sorry.

14 A. In tributary loading estimation, it's partly
15 an art and it's partly a science. There's always a
16 debate in the field of tributary loading estimation
17 when one uses a statistical method. When one develops
18 a statistical relationship between flow and
19 concentration data, whether one should use the
20 statistical -- the estimate from the statistical
21 regression equation on a day when one has an actual
22 measurement or should one skew that number and
23 substitute in the actual data number, if one has it.
24 There's a debate about this. There's no one right way
25 to do it. It depends on the system, it depends on

10403

1 parameter, it depends on many, many things.

2 Dr. Wells decided when he got the loads from
3 Dr. Engel, which were soluble phosphorus, not
4 soluble-reactive phosphorus; that is, the wrong thing,
5 Dr. Wells employed data substitution. And when he did
6 that, though, it further confounded problems because
7 he did not data substitute with soluble phosphorus, he
8 data substituted with soluble-reactive phosphorus.

9 So the time series that he actually put in
10 his model was a jumbled hybrid of some of the right
11 data and most of the wrong data.

12 Q. Didn't he use the regression on the total
13 phosphorus to get the soluble-reactive phosphorus for
14 his inputs? Correct?

15 A. Only for the predictions.

16 Q. Okay.

17 A. Not for the calibration.

18 Q. To fill the gaps, he used actually observed
19 data on inflow; is that correct?

20 A. He used the technique called "data
21 substitution" for soluble-reactive phosphorus for the
22 input loads for his model calibration. There was no
23 need to do that for his predictions. There were no
24 data on the predictions. By definition, there were no
25 data gaps. He used the regression.

10404

1 Q. Dr. Bierman, when you did your own
2 calculations of SRP, did you use all the data or just
3 use the USGS data?

A. Sitting here right now, sir, I can't recall.

5 Q. Okay. Well, isn't it true, though, that
6 Dr. Engel and Wells used both the OWRB and the USGS
7 data when they did their calculations?

8 A. That's what Dr. Engel stated he did for total
9 phosphorus, and we, in fact, did the same thing.
10 Sitting here right now, I can't recall whether that
11 was also the case for SRP, sir. I simply can't
12 recall.

13 MR. PAGE: Your Honor, is this an
14 appropriate time for a break?

15 THE COURT: It would be. We are in
16 recess.

17 | (Short break)

18 THE COURT: I'm noticing fewer and fewer
19 people. I can't imagine they're not absolutely
20 fascinated with these topics.

21 MR. PAGE: We're riveted, aren't we,
22 Your Honor?

23 MR. GREEN: Only the brave and the bold
24 are still here, Your Honor.

25 THE COURT: And the well paid.

10405

1 Mr. Page.

2 MR. PAGE: That means I'm brave and
3 bold, Your Honor.

4 *(Discussion held off the record)*

5 Q. (BY MR. PAGE) Dr. Bierman, I got a couple
6 more things and we'll finish up here.

7 A. Sure.

8 Q. You were asked during your direct examination
9 about Dr. Engel's opinion from his testimony where
10 Dr. Engel testified that once phosphorus leaves the
11 field, in his opinion it will eventually move on down
12 the waterways into Lake Tenkiller. Do you remember
13 those questions?

14 A. Yes, I do.

15 Q. Is it your testimony, sir, that you disagree
16 with Dr. Engel, that once phosphorus leaves the field,
17 it will not eventually get to Lake Tenkiller?

18 A. I disagree with the inevitability of it.
19 That's what I disagree with.

20 Q. So where is it getting lost, so to speak?
21 Let's say if it gets into the puddles and say there's
22 not enough rainfall to wash from the edge of the field
23 all the way to the stream, let's say it's left in a
24 puddle, is it your testimony that the phosphorus won't
25 eventually the next rainfall -- with sufficient

10406

1 rainfall it won't be moved on down to the stream?

2 A. No. Well, first of all, phosphorus doesn't
3 get lost because it's an element that's conserved,
4 it's neither created nor destroyed, so that doesn't
5 happen.

6 Q. And so it's not like PCBs or other things
7 that might change in form?

8 A. Well, sort of. But that's, I think -- my
9 testimony is not -- I don't believe my testimony
10 is -- is as you represented it in the question. I'm
11 not -- I'm not sure exactly how to answer your
12 question, sir.

13 Q. Well, let me try it another way then.

14 Will you agree with me, sir, and Dr. Engel
15 that once the phosphorus runs off the field, that a
16 substantial amount of it will continue into the
17 streams and rivers and eventually make its way to Lake
18 Tenkiller?

19 A. Well, without knowing what "substantial" is,
20 no, I don't agree with the statement as it's
21 represented there. I think that we're starting -- I
22 think the question you asked me first, the phosphorus
23 was still on the field and now all of a sudden it's in
24 the stream and river network, it's on its way to Lake
25 Tenkiller, and there are some steps I think we

10407

1 skipped.

2 Q. Well, the question you were asked was once it
3 begins running off a field, but you started at the
4 middle of the field in your answer.

5 My question was, I think, more closely
6 related to what Mr. George asked you --

7 A. Okay.

8 Q. -- and I want to focus on that.

9 Once it gets to the edge of the field, is it
10 your testimony that a substantial portion of that
11 runoff of phosphorus will not make it to Lake
12 Tenkiller?

13 A. I have no opinion on what portion of that
14 phosphorus -- well, if it -- if it comes off the field
15 and if it enters the stream and river network, I have
16 not formed an opinion on what portion of it could
17 possibly reach Lake Tenkiller.

18 And I guess if you're asking me -- if we're
19 talking about the question that Mr. George asked me,
20 if that's what you're doing, I would like to ask that
21 that question be repeated so I fully understand what
22 the premise of his question was.

23 Q. I think you answered my question, sir.

24 A. Okay.

25 Q. And I want to ask you another question.

1 You agree, though, sir, that if there's
2 phosphorus on or in the upper portions of the soil on
3 a field and there's enough rainfall for runoff, there
4 will be some phosphorus in that runoff?

5 A. There could possibly be phosphorus in that
6 runoff. But this case is about evidence, and I saw no
7 evidence that such runoff was demonstrated in
8 Dr. Engel's entire body of work.

9 Q. You're saying that the GLEAMS model did not
10 demonstrate runoff to the edge of the fields; is that
11 your testimony, sir?

12 A. No, no. My -- my -- the GLEAMS model
13 computed that phosphorus ran off to the edge-of-field,
14 but it's also my opinion that that model is -- the
15 model itself as applied to this watershed and the way
16 in which Dr. Engel -- is conceptually flawed -- and
17 the way in which Dr. Engel applied it is full of
18 mistakes and he never compared the output of that
19 model to any edge-of-field data. So therefore, the
20 model may have done some computations, but it was not
21 demonstrated that those computations were
22 scientifically valid correct or reliable.

23 Q. And you've done no study yourself, sir, that
24 would demonstrate that Dr. Engel's GLEAMS model
25 computations from the GLEAMS model runoff were wrong?

10409

1 A. They were wrong in that they were full of
2 mistakes, and I set that forth in my expert report.

3 Q. Dr. Bierman, did you do any of your own
4 studies to determine that Dr. Engel's field modeling,
5 the GLEAMS model that showed runoff on the edge of the
6 field, were wrong?

7 A. No, sir, I did no such studies.

8 Q. Will you agree with me, sir, that as
9 phosphorus increases in soil, that the runoff from
10 that soil phosphorus concentration will increase?

11 MR. GEORGE: Objection, Your Honor.

12 We're outside the scope of direct.

13 THE COURT: Sustained.

14 MR. PAGE: Your Honor, I think it goes
15 to this question of transport, that he went to
16 Dr. Engel when he complained that there wasn't a
17 runoff that would continue.

18 MR. GEORGE: May I respond?

19 THE COURT: Any response? Yes.

20 MR. GEORGE: Your Honor, the only thing
21 this witness was asked about in that regard was the
22 assumption made by Dr. Engel regarding the
23 inevitability of delivery. He wasn't asked about
24 Dr. Engel's beliefs on the relationship between soil
25 test phosphorus and runoff.

10410

1 THE COURT: The objection's sustained.

2 Q. (BY MR. PAGE) Dr. Bierman, you mentioned
3 when you were talking about the processes of
4 phosphorus in Dr. Engel's assumption or testimony that
5 it continues to move downstream.

6 What processes are you aware of in the IRW
7 that will remove phosphorus from a stream once it's
8 reached the stream?

9 A. Remove it from the water column or remove it
10 from the coupled water column sediment system? What
11 do we mean by "the stream"?

12 Q. The latter, sir.

13 A. Deep burial.

14 Q. Deep burial?

15 A. It's -- sedimentation -- excuse me. Excuse
16 me. No. That's -- let's say -- excuse me. Let me
17 gather my thoughts.

18 Let's say burial in this sense. Solids with
19 phosphorus attached are in the water column of the
20 Illinois River. Many things happen to that
21 phosphorus. Many things happen to the solids. One of
22 the things that could happen is the solid could settle
23 to the bottom. Another thing that could happen is the
24 solid to be resuspended and eroded and then carried
25 down field.

10411

1 But another thing that could happen -- and
2 this depends on -- this depends on flow velocity, it
3 depends on the geometry of the river, depends on many,
4 many things -- one of the things that could happen is
5 it could just stop and start collecting in a hole and
6 there would be what's called "sediment burial."

7 There probably are locations in the Illinois
8 River system which are low-energy zones where the
9 sediments and phosphorus are collected.

10 Q. Okay, sir. Now, you said there were many
11 things that can happen and you identified one; that
12 is, sediment burial.

13 Now, are there any other things that you say
14 that will happen once phosphorus reaches the stream to
15 prevent it from getting to Lake Tenkiller?

16 A. Well, I said there were many things that
17 could happen.

18 Q. Well, how many of those are applicable to the
19 IRW?

20 A. It's a -- it's a natural system. So probably
21 as many things are as applicable as I could possibly
22 think about because the ecosystem is extremely
23 complex.

24 One more thing could be -- it could be -- the
25 phosphorus could be taken up by -- by rooted

10412

1 vegetation. It could pass up the food chain into
2 fish. The fish could be caught and harvested. There
3 were many things that could possibly happen to
4 phosphorus.

5 Q. Okay. Well, let's look at those just briefly
6 because we want to see if they're really important or
7 not. Let's, first of all, talk about the burial.

8 Now, is it your testimony, sir, that there
9 are burial locations of phosphorus in IRW rivers and
10 streams that aren't flushed out periodically by high
11 rainfall?

12 A. No. I'm saying that in any stream system,
13 including the IRW, these zones of low energy could
14 possibly exist -- and I have no basis for stating they
15 do or do not exist in the IRW -- they could probably
16 exist, and if they do exist, these would be zones
17 where sediment, and hence phosphorus, could
18 accumulate. That's all I'm saying.

19 Q. Okay. So you're just speculating as to
20 whether that's going on in the IRW?

21 A. Well, you asked me, I thought, to describe
22 processes that could influence the fate of phosphorus
23 as it moves through the system, and I'm trying to be
24 responsive to your question.

25 Q. But earlier on direct, you said there's a lot

10413

1 of things that can happen to phosphorus in streams.
2 You were talking about that in conjunction with your
3 critique of Dr. Engel's opinion. And I'm trying to
4 explore how much specific information you have in
5 order to form your basis of your critique.

6 A. I'm not sure I connected it to Dr. Engel's
7 opinion. I'm trying to answer the question of are
8 there processes in streams that could prevent
9 phosphorus from not making it down? I mentioned one
10 and I could continue to mention others.

11 Q. Okay. Well, on the deep burial, do you have
12 any basis to believe that there's any permanent deep
13 burial of phosphorus in sediments in any stream or
14 river of the IRW?

15 A. No. Because I haven't conducted such an
16 investigation and I'm not forming that opinion about
17 the IRW. I'm simply answering your question that this
18 could be possible.

19 Q. Okay. Let me ask you another question. You
20 talked about plant uptake.

21 A. Yes.

22 Q. Be, I guess, aquatic plants?

23 A. Yes.

24 Q. Now, you would assume, though, that the
25 plants could be -- they'll live and then they'll die,

10414

1 and then what happens to the phosphorus when the plant
2 dies?

3 A. Well, we'd be back at your first question.

4 The phosphorus might be in the waterbody. Now what
5 could happen to it next?

6 Q. Are you saying that aquatic plants
7 permanently remove phosphorus from the system so it
8 will not move down to Lake Tenkiller?

9 A. No, I'm not. It depends what happens to the
10 plant. If the plant grows and dies in the system, the
11 phosphorus remains in the system. It may, after the
12 plant dies, end up back in the water column. It may
13 end up down in the sediments. They have roots. It
14 just depends how far down the roots go. There are any
15 number of things that could happen.

16 Q. Do you have any basis, sir, from any study
17 that that is a substantial means of removal of
18 phosphorus that's entered streams and rivers of the
19 IRW?

20 A. No, sir. I'm not expressing that opinion
21 because I haven't conducted that analysis in the IRW.

22 Q. And finally, let's look at the one you talked
23 about fish.

24 A. Yes, sir.

25 Q. You said they could take up some phosphorus

10415

1 or some algae that had some phosphorus in it and be
2 harvested.

3 Do you have any basis to believe that that is
4 a substantial removal of phosphorus from IRW rivers
5 and streams; that is, harvesting of fish?

6 A. I have no basis to form any opinion about the
7 quantitative significance of fish removal from the
8 system.

9 Q. Thank you, Dr. Bierman.

10 MR. PAGE: I pass the witness.

11 THE COURT: Redirect.

12 **REDIRECT EXAMINATION**

13 **BY MR. GEORGE:**

14 Q. Good afternoon, Dr. Bierman.

15 A. Good afternoon, Mr. George.

16 Q. At the risk of someone throwing something at
17 me, I want to revisit just briefly this whole
18 coefficient issue, okay?

19 A. Certainly.

20 Q. Is it your understanding that Dr. Engel
21 calibrated his model more than once?

22 A. Well, he calibrated the model at least three
23 times that I know of because he had a routing model
24 spreadsheet with his original report, one with his
25 errata, and one was given to us on October 15th.

10416

1 Q. Okay. And when -- and you recalibrated
2 Dr. Engel's model as part of your test; is that right?

3 A. That's correct.

4 Q. Okay. Now back to Dr. Engel. Did the
5 coefficients from his calibration for his first report
6 and his second report change?

7 A. Yes, sir, they did.

8 Q. Okay. So, Dr. Bierman, is there anything
9 magical about those numbers?

10 A. I wouldn't know about --

11 MR. PAGE: Objection, Your Honor;
12 ambiguous.

13 THE COURT: Rephrase, please.

14 MR. GEORGE: Certainly.

15 (*Discussion held off the record*)

16 Q. (BY MR. GEORGE) Let me approach it this way,
17 Dr. Bierman.

18 From your review of Dr. Engel's expert
19 report, did he contemplate movement in those numbers?

20 MR. PAGE: Objection, Your Honor;
21 leading.

22 A. That calls for speculation on my part.

23 THE COURT: Sustained.

24 MR. PAGE: Sustained. Good.

25 Q. (BY MR. GEORGE) Work with me, Doctor.

10417

1 A. Please repeat the question, sir.

2 Q. Certainly. Did Dr. Engel establish some
3 limits on the range in which those coefficients --

4 A. Oh, I understand that question.

5 Q. -- can change?

6 A. Now I understand. Unfortunately, the answer
7 has two parts, not one part. I hate to make this more
8 complicated than it is but full disclosure requires
9 it.

10 In the original expert report and in his
11 errata, Dr. Engel used the SCE, the calibration
12 algorithm, for not just his GLEAMS model, but also for
13 his routing model, whereas in the October 15 version,
14 the current version, the latest version, he told us
15 that he just manually calibrated it.

16 Okay. So why am I telling you this? Well,
17 in the SCE algorithm, the algorithm needs to be told
18 what the starting value is and it needs to be told
19 what the search ranges are for the parameters. So in
20 those first two versions, he had a starting value and
21 he had plus or minus values. So there were ranges
22 over which those parameters were allowed to be
23 adjusted.

24 In his deposition, he was asked if there was
25 any physical significance to these numbers, if they

10418

1 had to be within certain ranges. And my recollection
2 is that he said, well, gee, they don't have any
3 physical meaning, they're not really -- they're not
4 really constrained.

5 Q. Okay. Did you remain within his limits in
6 making any adjustments that were made as part of your
7 calibration to those coefficients?

8 A. Yes. Just to remain faithful to exactly what
9 he did, the sensitivity analyses in my expert report
10 with his routing model, all four of them, I did
11 not -- the values for the coefficients in my
12 recalibrations did not exceed the ranges that
13 Dr. Engel himself actually used, even though he said
14 they weren't physically bounded by these ranges.

15 Q. Thank you, Doctor.

16 MR. GEORGE: No further questions, Your
17 Honor.

18 THE COURT: Recross?

19 MR. PAGE: Nothing further, Your
20 Honor.

21 THE COURT: Very well. You may be
22 excused.

23 THE WITNESS: Thank you, Your Honor.

24 THE COURT: The defendants may call
25 their next witness.

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1 MR. GEORGE: Your Honor, I'm pleased to
2 report that we have been more efficient than we could
3 have even anticipated and --

4 THE COURT: Imagine that happens on a
5 Thursday afternoon?

6 MR. GEORGE: Yes. Astonishing, complete
7 coincidence.

8 Yeah, Your Honor, we are pleased to have
9 gotten on nine witnesses this week, but we don't have
10 another one in town or another deposition ready to
11 play.

12 THE COURT: That's fine.

13 MR. GEORGE: Your Honor, I believe that
14 Mr. Bullock wants to address the court on the subject
15 generally of planning for closing. He and I have
16 talked a little bit about it but I'll defer to him.

17 THE COURT: All right.

18 MR. BULLOCK: Just in terms of our
19 preparation for what we all I know hope is coming is
20 the issue of closing arguments --

21 THE COURT: When might we expect that?
22 Have you had discussions in that regard.

23 MR. BULLOCK: Well, we've had -- the
24 defendants probably are better to speak to that than
25 might I repeat what they said and they're to correct

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1 what I said. So I'll let them say it.

2 MR. GEORGE: I slipped away too quickly,
3 Your Honor.

4 We are -- it is conceivable that the
5 defendants will be in a position to have completed
6 calling their witnesses by the end of next week on our
7 four-day trial calendar. Of course, that depends on
8 the scope of cross. We are in the process of
9 evaluating the remaining list of witnesses and are
10 trying to decide whether we can pare a few of them
11 down. But I want to alert the court and the
12 plaintiffs to at least the possibility that we'll be
13 done calling defense witnesses the end of next week.

14 I think -- I mean, candidly I'm not sure that
15 I have seen something that would justify rebuttal, but
16 there's always the auspices of a potential rebuttal
17 case. And so for planning purposes, it might be
18 helpful to know whether at this moment whether the
19 state has identified any rebuttal witnesses that they
20 intend to call. That obviously would prolong the date
21 for closing.

22 THE COURT: Right. One moment.

23 Mr. Overton.

24 *(Discussion held off the record)*

25 THE COURT: All right. The 18th is

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1 Martin Luther King. On the 19th, I still have a
2 criminal case that may go to trial and that would
3 potentially bump you a couple of days. We have the
4 pretrial tomorrow so I'll know more by Monday as to
5 whether or not that's going to go.

6 Mr. Bullock.

7 MR. BULLOCK: With those thoughts in
8 mind, in terms of rebuttal, I'm not sure at this
9 point, Judge. We're still assessing both the
10 testimony that's been offered, and particularly the
11 testimony today, as to whether it's necessary to call
12 any rebuttal. I'm sure that anything that we do call
13 will be short and not be significant in terms of the
14 length of this. But I'm certainly not ruling it out
15 and I'm not asking the court to rule on that issue
16 today.

17 As for the length of closing so that we can
18 start getting that constructed, of course Rule 39.1
19 talks about the court setting some limits. We did
20 have a full day of openings. We've just had within
21 the last month almost three days of argument on the
22 Rule 52. And so it's my view that whatever we
23 do -- and then we also have the findings and
24 conclusions that will follow.

25 And so in light of that, I would think some

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1 reasonable limitations ought to be considered by the
2 court.

3 THE COURT: Yeah, the Rule 52 motions
4 went longer than I had expected or hoped. I'm well
5 aware that essentially what boils down to a Title 50,
6 Section 4 issue is still pending before the court, and
7 frankly I'm not entirely comfortable yet with that.
8 We've had folks working on it in chambers, but I'm not
9 entirely comfortable with it yet to rule on.
10 Obviously, in light of what's developed during trial,
11 I'm taking that Rule 52 motion very seriously but I'm
12 not comfortable on it.

13 I understand now that you've raised the
14 issue, I need to rule on it very quickly because
15 you're trying to prepare for these closing arguments.

16 MR. BULLOCK: Right, right.

17 THE COURT: Go ahead.

18 MR. BULLOCK: Okay. And so it was our
19 thought that in terms of that -- and we have had some
20 discussions with the defendants -- we thought that
21 perhaps if we did like two hours a side, the plaintiff
22 will divide theirs of course some for opening and
23 rebuttal, and then the defendants can divide theirs in
24 terms of their joint defense, which is substantially
25 the case, and then some individual defense.

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1 You know, the same argument, of course,
2 applies. They say, well, there's all of us. Well,
3 we've got to answer to all of those and prove our
4 case. And so we were thinking something along the
5 lines of a couple of hours of closing a side would
6 probably, in light of all the other argument and
7 briefing, be sufficient even given the length of this
8 trial.

9 THE COURT: Your thoughts, Mr. George?

10 MR. GEORGE: Your Honor, the defendants
11 certainly share the view there ought to be some time
12 constraints placed on closing argument and we don't
13 view closing as a multi-day affair. I have not yet
14 had an opportunity to circle the group to get a time
15 estimate that I can provide to the court, but I'll be
16 happy to do that and provide it on Monday. I
17 certainly think something in the range of two to three
18 hours, but that's my personal view and I don't want to
19 short-change some counsel who may have something
20 specific and rather lengthy they want to say for their
21 client.

22 So if the court would grant us that leave to
23 consider that and provide a time estimate on Monday?

24 THE COURT: Yeah. Why don't you do
25 that. I think like page limitations, it does help to

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1 focus argument. So we'll keep that in mind and
2 certainly curtail it substantially from the time taken
3 on the Rule 52(c) motions.

4 MR. GEORGE: Certainly, Your Honor.

5 THE COURT: Anything else?

6 MR. GEORGE: May I raise -- I'm sorry,
7 Louis -- may I raise one other idea for the court's
8 consideration?

9 I've had different experiences, as I'm sure
10 learned counsel on both sides of this room have had,
11 in federal court in a bench trial in terms of how
12 certain judges want their closing conducted and what
13 they want to have in advance. And I know Your Honor
14 has expressed a desire to receive proposed findings
15 and proposed conclusions after closing, and I also
16 appreciate that Your Honor and your staff is weary of
17 briefing. So I don't want to presume anything here.

18 But some judges, in my experience, have found
19 some benefit in having some briefing in advance of
20 closing, and I don't know what your view is.

21 THE COURT: No. I do think in this
22 case -- and let me put some thought to it and I'll get
23 to you next week -- I do think that some briefing
24 focusing in on the remaining issues may be helpful.
25 So let me think about that.

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1 MR. GEORGE: Certainly.

2 THE COURT: We'll put our heads together
3 and think whether that's necessary or not.

4 MR. GEORGE: Okay.

5 THE COURT: Thank you.

6 MR. BULLOCK: There was one other thing
7 that I was asked to bring up by some of the staff
8 whose job it is to put this together for the court.

9 In terms of providing the court with copies
10 of the exhibits, I know that the court has gotten and
11 annotated its exhibits, of course, as we've gone
12 along. I guess our thought would be that we could
13 provide the court pretty easily and quickly with
14 perhaps a DVD with copies of all the exhibits that's
15 hyperlinked to listed exhibits showing admitted or not
16 admitted so that -- and then --

17 THE COURT: For instance, hyperlinked to
18 the proposed findings and conclusions?

19 MR. BULLOCK: Well, I think we could
20 even do that, Judge.

21 THE COURT: Because we've tried to
22 maintain -- although as you've referred to before,
23 we've tried to maintain the exhibits back here that
24 have been admitted. Personally, I like hard copies to
25 hold on to, but it might be helpful to refer in those

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1 findings and conclusions to those exhibits that you
2 believe substantiate the proposed findings.

3 MR. BULLOCK: Well, I think that might
4 be possible. I'm not a techie as the court knows, but
5 we will confer and confer with the defendants to see
6 whether that's something feasible. It certainly is
7 enticing from this end.

8 THE COURT: All right. Anything else?

9 MR. GEORGE: Nothing from our side, Your
10 Honor.

11 THE COURT: All right. Very well. If
12 there's nothing further, we will be adjourned until
13 next Monday.

14 *(The proceedings were recessed)*

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1 C E R T I F I C A T E
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4 I, Brian P. Neil, a Certified Court Reporter
5 for the Eastern District of Oklahoma, do hereby
6 certify that the foregoing is a true and accurate
7 transcription of my stenographic notes and is a true
8 record of the proceedings held in above-captioned
9 case.

10

11 I further certify that I am not employed by
12 or related to any party to this action by blood or
13 marriage and that I am in no way interested in the
14 outcome of this matter.

15

16 In witness whereof, I have hereunto set my
17 hand this 7th day of January 2009.

18

s/ Brian P. Neil

19

20 Brian P. Neil, CSR-RPR, CRR, RMR
United States Court Reporter

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